DECEMBER, 1953

APPLIED HYDRAULICS

THE MAGAZINE OF FLUID POWER TRANSMISSION

INCLUDING AIR CONTROLS AND AIR CIRCUIT DESIGN; ELECTRICAL CONTROLS

DESIGN OF A FATIGUE TESTING MACHINE Page 38

4 WAYS TO USE AIR TO INCREASE MACHINE OUTPUT Page 66

CONTROL CIRCUITS FOR HEAVY PRESSES Page 68

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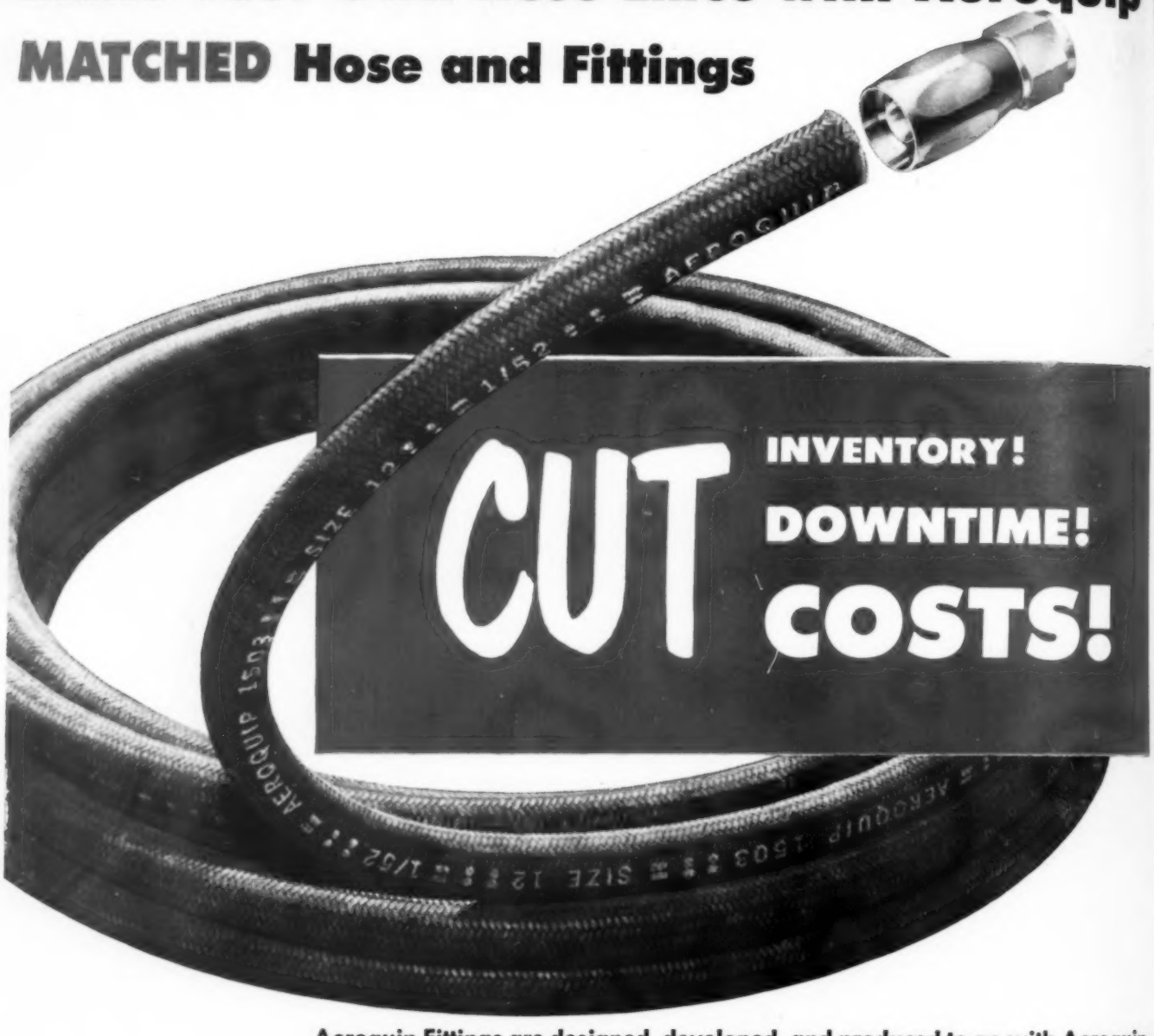
AIRCRAFT CONTROL SYSTEMS DESIGNED FOR SAFETY Page 99

BANCHISE
IRCULATION

Listed on page 2 you'll find 14 articles and 5 regular departments which feature application and design ideas for fluid power equipment

Make Your Own Hose Lines with Aeroquip MATCHED Hose and Fittings



Aeroquip Fittings are designed, developed, and produced to go with Aeroquip Hose. They form such a foolproof combination that Aeroquip *guarantees* performance. Thus, the hose lines made right in your own plant always measure up to Aeroquip's exacting standards of quality, the highest in the industry. A small supply of Aeroquip Bulk Hose and Fittings assures you of quick hose line replacements at all times . . . and Aeroquip Fittings are detachable and may be used again and again when making new hose assemblies.

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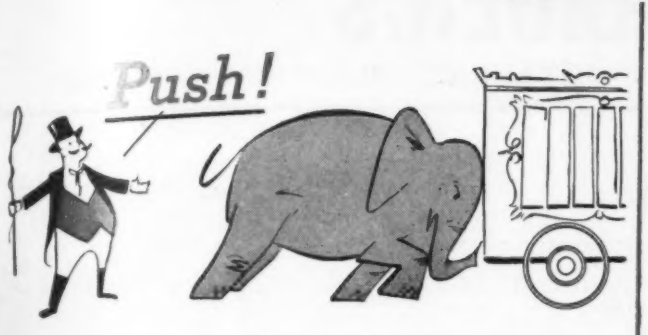

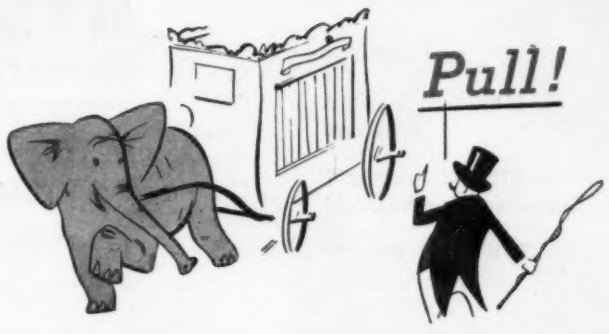

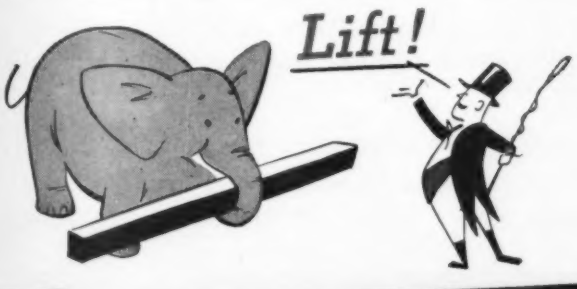

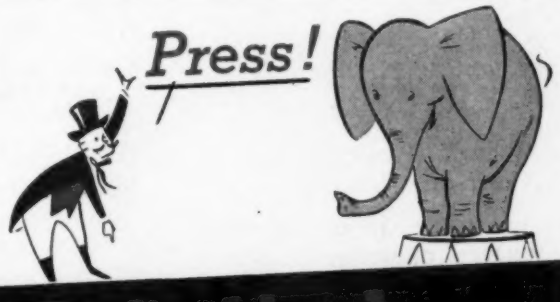

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- Heat-treated alloy socket head screws are closely spaced for maximum strength.

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HYDRAULIC AND PNEUMATIC EQUIPMENT • CYLINDERS • VALVES • RIVETERS

DECEMBER, 1953
Vol. 6, No. 12

APPLIED HYDRAULICS

PNEUMATICS - HYDRAULICS - ELECTRICAL CONTROLS

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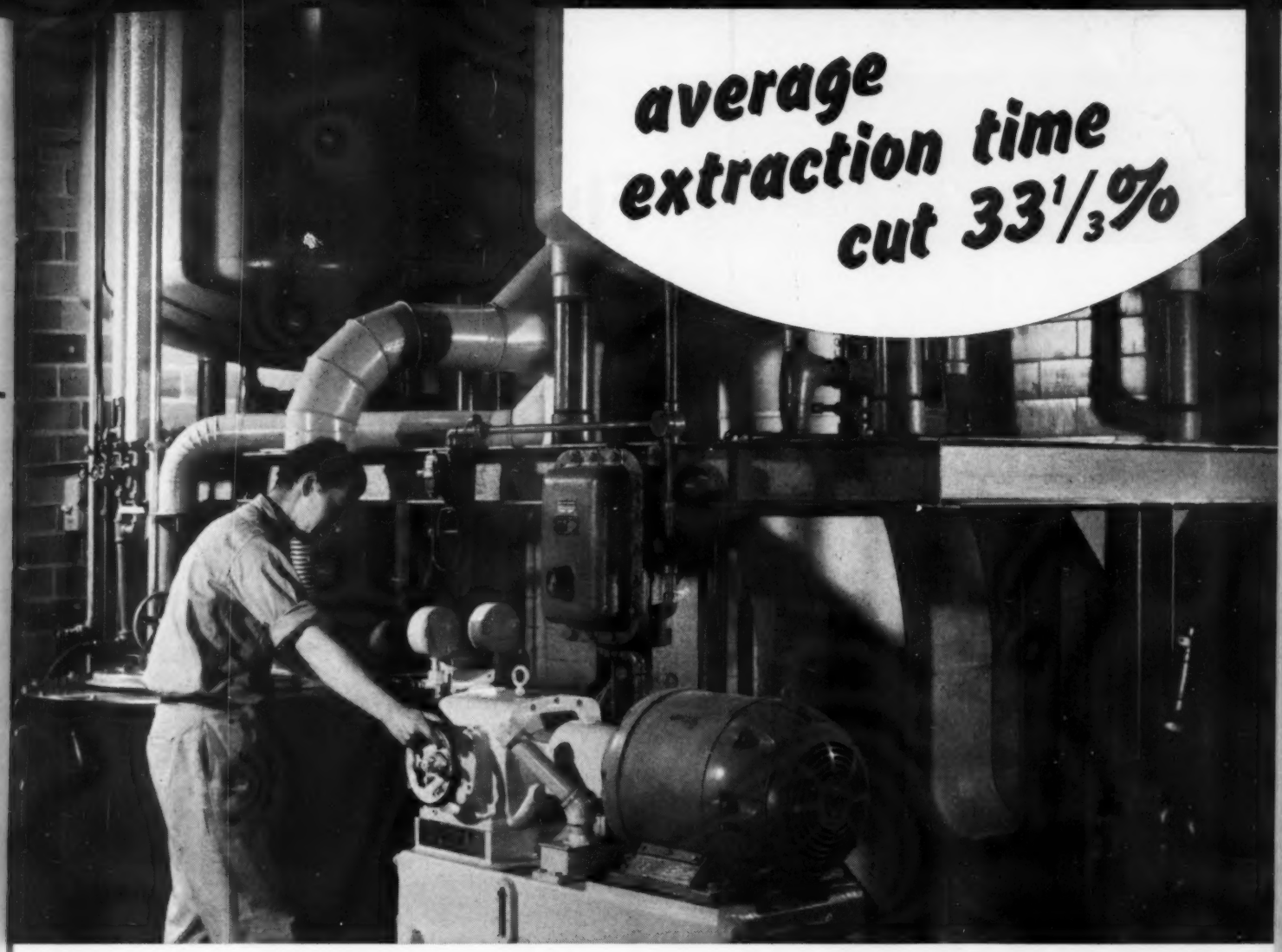


Once more the ANY-SPEED Oilgear Drive betters machine performance "painlessly"

Many times in our experience the performance of an already highly efficient machine has been bettered without redesign, solely by changing the drive. One case out of many *varied* cases, is the Tolhurst Centrifugal pictured above, located in a great pharmaceutical house. This centrifugal was originally equipped with a two-speed electric motor drive. However the chemicals it is called upon to handle have widely varying crystal packing characteristics. Some of these crystals packed so densely at the speed available, extraction was inhibited, extraction time far out of balance and crystal removal difficult.

A change was made to an *"ANY-SPEED"* Oilgear Fluid Power Drive. Now the operator is able to shade the speed of the centrifuge experimentally—*and easily discover* the *best* speed for each batch of crystals.

As a result, extracting that used to take from 6 to 9 hours was cut to 4 to 6 hours. The extremely slow speed also available made unloading a great deal easier. This user now has several other Oilgear drives including one on a laboratory centrifuge.

There is very often a direct efficiency coefficient between machine operating speed and the type of work being handled. And we can cite many widely varying instances where equally dramatic and profitable gains resulted at once from a simple change to *"ANY-SPEED"* Oilgear Fluid Power Drives. If you want some interesting factual data on Oilgear's steplessly variable speed drives, their outstanding responsiveness to control impulses, their smooth acceleration and deceleration, talk to an Oilgear Engineering Representative. His mature and sound engineering recommendations may profit you greatly. THE OILGEAR COMPANY, 1564 W. Pierce St., Milwaukee 4, Wisconsin.

OILGEAR

OILGEAR

APPLIED HYDRAULICS

Fluid Power Lines

You Can Enter the 1954 Prize Paper Contest

On page 31 of this issue we've announced the Second Annual APLIED HYDRAULICS Prize Paper Contest. There are no limitations as to who may enter. Entries may be individually prepared or coauthored.

Any phase on the design, application or maintenance of hydraulic or pneumatic components, assemblies or systems to industrial equipment may be selected.

You'll be competing for one of seven prizes which total $1200. You can get a good guide on how to prepare your article by studying the 1953 prize winning papers. Several papers were published in October and November, and you'll find one in this issue. The contest closes June 1st. Don't miss it—write us for your entry blank now.

Safety in Design

Being that we get into an airplane from time to time, we take no issue with the design yardstick used in this month's Aviation article. According to the authors, Chalmers A. Strayer and Wilfred F. Talbot, the measure of success for the control system is safety and reliability. Today's high speed jet aircraft present new control problems. Will fluid powered control systems be able to solve these problems? The article details the development of the full powered control systems and tells how many of the design problems were overcome.

Making Sanding Belts

You probably aren't making sandpaper. However, we're sure that on your fluid power equipment you have to solve some of the same problems which confront the engineers in Carborundum's Coated Products Division. Early this year, we stopped at Carborundum and were pleased to meet again with Bill Hallatt, with whom we had attended a short course at MIT. Bill showed us the equipment in their shop and pointed out several air and oil operated devices which had solved a production or maintenance problem. One of these devices is described in this issue. It's a method for synchronizing hydraulic cylinders. You may have a use for it.

Air Ideas

In this issue there are four articles which tell you about a total of 10 applications of air power. Look around your plant. We're sure that you can apply many of the ideas given in these articles to improve or speed up production, or to reduce maintenance on present equipment. The end result may mean better quality in your product. You may also cut down on labor turnover by using air to reduce tiring operations.

New Products Coming

1954 will see several new pumps and valves introduced for fluid power applications. We saw a preview of some of the products at a recent meeting of sales representatives for Hydreco and Dudco divisions of The New York Air Brake Company and for Double A Products Company. Availability of these products, which will be announced early in the year, will assist in building better more versatile hydraulic systems. Performance, economy and versatility are being stressed in component design. These products along with new and improved lines released by other manufacturers will widen the application and efficiency of fluid powered machines.

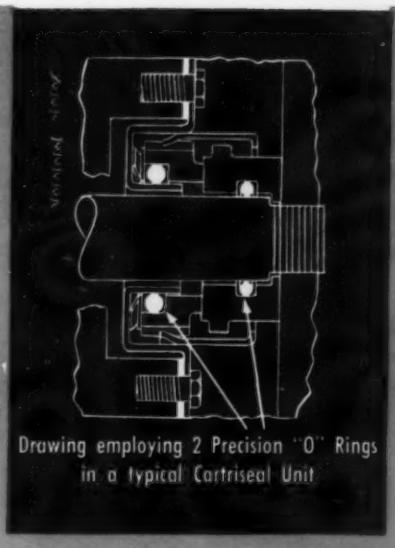
Bigger and Better January Directory Issue

You'll find that your copy of the 1954 Buyer's Guide for the fluid power field will be the best reference for finding who manufactures what in the way of air and hydraulic components and the allied electrical and mechanical devices. The Buyer's Guide will list more than 700 manufacturers. In the industrial product directory, manufacturers of 140 products will be listed.

To make sure that you find the product you want, we've included 170 cross-references. Almost every product is called by more than one name. You may know one and not the others. If the name you know isn't shown as a main listing you can be sure to find it as a cross-reference. It's the best way to give you a complete directory, which will be used throughout 1954.

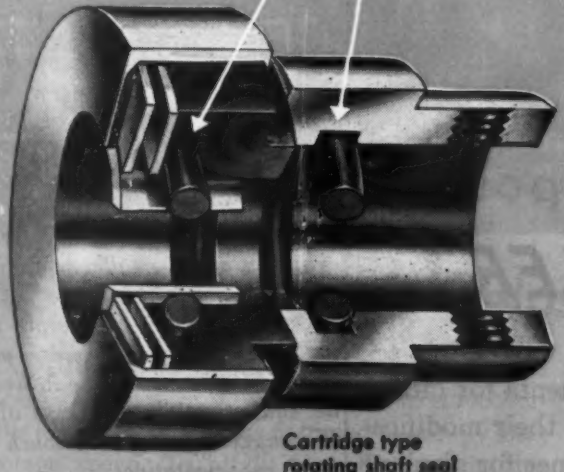
In this 4th Annual Directory, you'll have a section covering over 75 circuits which are used on air and hydraulic machines. Each circuit has a design suggestion. You will have the most complete collection of fluid power circuits ever published under one cover.

Precision "O" Rings assure



Drawing employing 2 Precision "O" Rings in a typical Cartriseal Unit

proper cushioning, perfect performance, positive sealing for CARTRISEAL UNITS



Cartridge type rotating shaft seal

Compact, dependable cartridge type sealing units, made by *Cartriseal Corp.* of Chicago, replace bulky, old-fashioned packing rings and solve many rotating shaft sealing problems. In order to assure *highest quality* and positive, leak-proof service, *Cartriseal* engineers specify *Precision* "O" Rings for these hydraulically balanced, easy-to-install units!

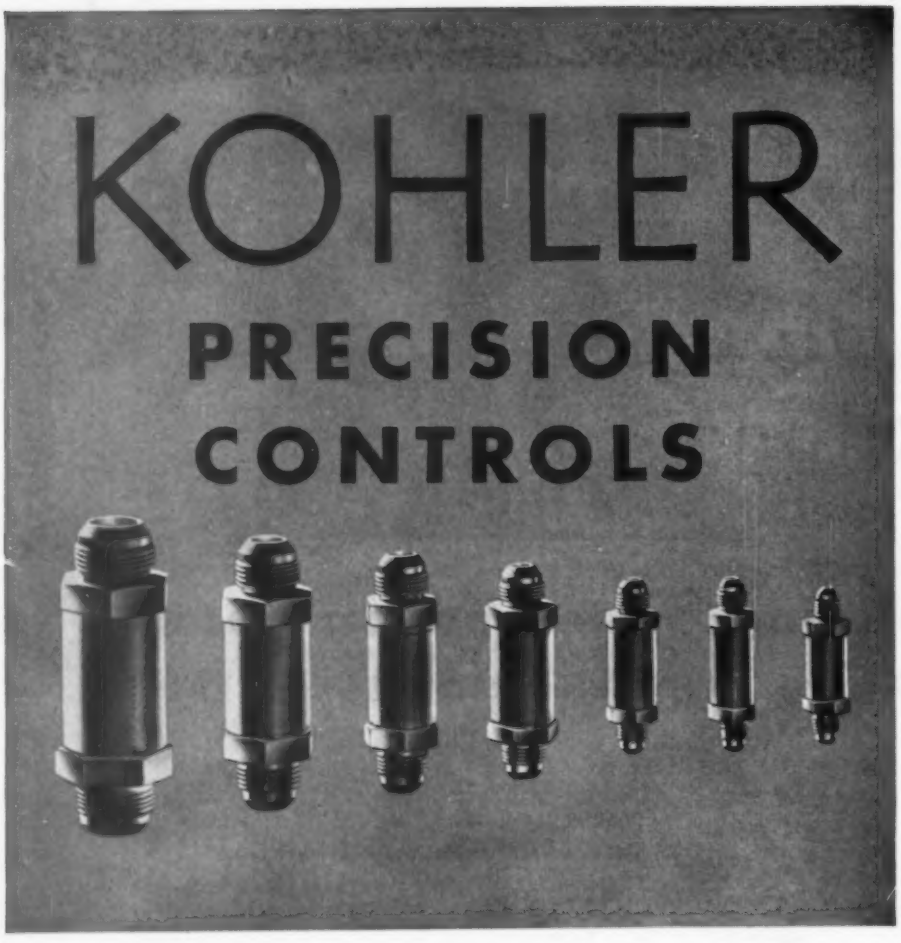
Everyone is finding Precision "O" Rings the best answer to many sealing problems—and they are finding, too, that *Precision* leads the field in engineering help. Let us help you. Send for our "O" Ring Handbook and let us have your inquiries.

FREE—Write for your personal copy of our Handbook on "O" Rings.

Precision Rubber Products CORPORATION

"O" Ring and Dyna-seal Specialists

Dept. 1, Oakridge Drive, Dayton 7, O. **Canadian Plant at: Ste. Thérèse de Blainville, Québec**



For check valves that are positive

specify KOHLER*

This series of K-1207 hydraulic check valves in sizes from ¼" x 1" may solve your requirements for CHECK VALVES THAT CHECK. These valves, or their modifications are used in hydraulic actuating lines for airplane landing gear, for operating machine tools, and for forked lift trucks. Since each valve is precision lapped, their positive checking action prevents leakage and insures long service life.

Facilities for forging, casting, machining, anodyzing are maintained all in one plant—with an organization skilled in precision workmanship. Call on us for your next check valve requirement.

**Kohler Co. is the only supplier with AN approval for all 7 sizes of the K-1207 check valve series.*

Kohler Co., Kohler, Wisconsin. Established 1873

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PLUMBING FIXTURES • HEATING EQUIPMENT • ELECTRIC PLANTS
AIR-COOLED ENGINES • PRECISION CONTROLS

LETTERS to the Editor

Equipment for Dump Platforms

We have some inquiries from grain and feed dealers for hydraulic equipment to raise platforms that will be loaded with trucks up to trailer tractors that weigh approximately 30 tons. The idea is to raise the front end of the trucks so that the load can be dumped into pits or conveyors. Please advise the names of organizations that can figure on equipment that could do this sort of job.

ALEX T. GRIER
President
The R. D. Grier & Sons Co.
Salisbury, Maryland

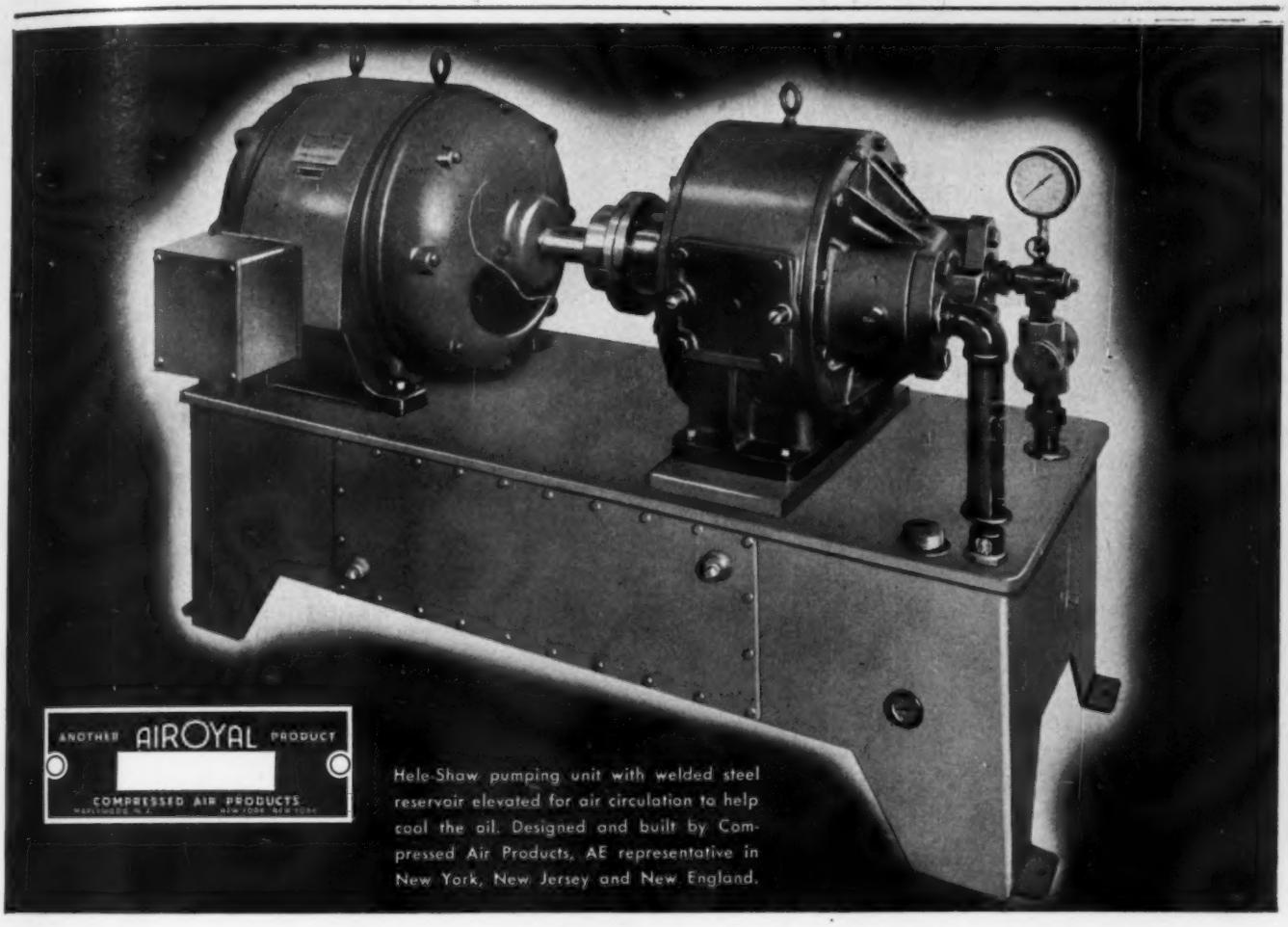
This problem could be approached in several ways. Cylinders, including telescoping cylinders might be used to tip up the platform. Hydraulic reciprocating rotary actuators might be used. It might be possible to do the job with smaller sets of cylinders and a smaller pump if the platform could be pivoted off center on the rear side. We are sending you the names of several manufacturers who specialize in hydraulic equipment for this type of use. We suggest you get in touch with local representatives.

Accumulator for Chemical Plant Flow Meter Service

Could you refer us to a manufacturer of hydraulic accumulators whose unit might be suitable for the following service: accumulator as an isolating unit for flow meter service; one side of the accumulator to be connected to the fluid being metered; the other side to be filled with either oil or water and connected to the flow meter body. The pressure differential across the separator should be .1 inch of water or less. The displacement of the meter will not be more than 500 ml. A typical liquor to be metered would be lake brine; average oper-

Continued on page 10

WHEN IT'S HIGH PRESSURE, IT'S **AMERICAN!**



Hele-Shaw pumping unit with welded steel reservoir elevated for air circulation to help cool the oil. Designed and built by Compressed Air Products, AE representative in New York, New Jersey and New England.

AE representative helps "pancake" brass scrap

EXTRUSION of brass pipes and shells involves a certain amount of discard. This scrap is recoverable for future use, but is flattened to occupy least storage space. To attain top efficiency in this "pancake" operation, American Brass Company, Waterbury, Conn., recently called on Compressed Air Products, to power a hydraulic press. They promptly designed, built and installed a pumping unit . . . using a JHP-12 Hele-Shaw Pump.

The famous Hele-Shaw is a radial-piston, variable displacement, fluid power generator . . . engineered and built for longest service life. Discharge can be varied from zero to maximum, and it can be reversed instantly or gradually.

When you have a high pressure hydraulic pumping system problem, your local AE representative can solve it . . . save real time and money on engineering and construction . . . assume local responsibility for continuous, efficient service.

Mail the coupon for full information about Hele-Shaw for variable displacement to 110 g.p.m., (pressures to 3000 p.s.i.); on the Hydramite for constant displacement to 60 g.p.m., (pressures to 5000 p.s.i.).

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AE Products are: Taylor and Perfect Spread Stokers, Marine Deck Auxiliaries, Hele-Shaw and Hydramite Fluid Power, Lo-Hed Hoists, Lo-Hed Car Pullers.

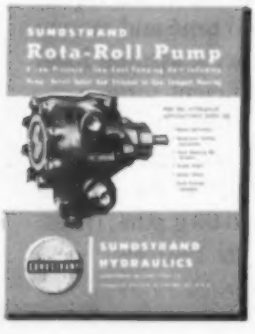
American Engineering Company
2530 Aramingo Avenue, Philadelphia 25, Pa.

Gentlemen: Kindly send me complete information about the ☐ Hele-Shaw Pump. ☐ Hydramite.

Name.....Title.....
Company.....
Address.....
City.....Zone.....State.....

SUNDSTRAND

Pump • Built-in Relief Valve • Strainer...all in one compact unit!



FREE—Complete descriptive brochure on features, capacities, mounting arrangements, etc. Ask for Bulletin 139-1.

• Here's a "ready-made" answer for solving problems of engine and bearing lubrication, small cylinder actuation, low-capacity oil transfer, and many other similar applications. Sundstrand's Rota-Roll Pump gives you a pump, valve, and strainer in an extremely compact unit, making it particularly adaptable where space is limited. Pump is Rota-Roll design . . . inner member geared to shaft turns outer member at 25% slower speed, insuring smooth operation, long life. Self-emptying principle of pump prevents back-surging or turbulence. Volumetric efficiency is approximately 90%. Adjustable relief valve can be furnished in any of four pressure ranges: 20-40 psi; 40-80 psi; 80-150 psi; 150-300 psi. Large, easy-to-clean strainer is readily accessible, easily removed for cleaning. Husky 7/16" shaft and long, self-lubricating shaft bearing permit mounting for pulley operation. High-speed production line methods give you a complete, compact unit at an exceptionally reasonable price. Thorough factory testing insures unit is ready for immediate use without further checking. Write, wire or phone for complete details today.

*Based on motor speed of 1725 rpm and 100 psi.

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SUNDSTRAND MACHINE TOOL CO.

HYDRAULIC DIVISION, ROCKFORD, ILL.

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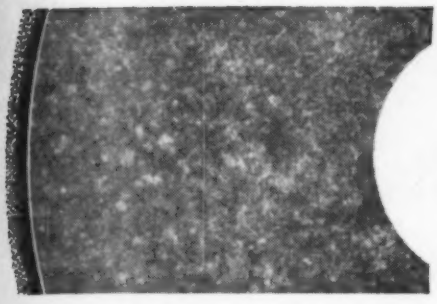
LATHES • MILLING, BROACHING AND SPECIAL MACHINES • BROACHING TOOLS • MAGNETIC CHUCKS

GRADUATED DENSITY

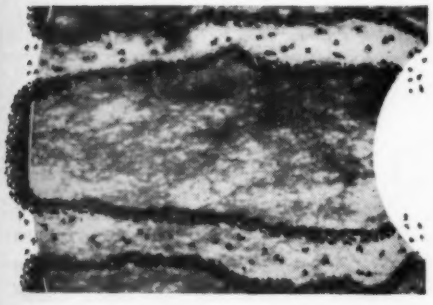
makes MICRO-KLEAN the most effective filter on the market!

How MICRO-KLEAN compares with other cartridge filters



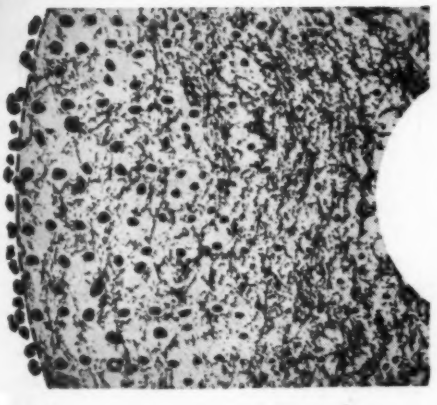
***Compare* MICRO-KLEAN with**

FILTERS WITH THE SAME DENSITY THROUGHOUT. The filter media density is the same on the pressure and discharge surfaces of the element; therefore, dirt accumulation is largely on the outside surface, choking the cartridge ("plastering") and reducing the effective filter life.



***Compare* MICRO-KLEAN with**

FILTERS WITH HAPHAZARD DISTRIBUTION OF FILTER MEDIA. Uneven haphazard media density permits fluid to find channels through the filter, and pass solids larger than the minimum filter spacing.



***Now Look* at the advantages offered by MICRO-KLEAN.** See how the fibre density increases toward the discharge side of the MICRO-KLEAN filter cartridge? In effect, every Cuno MICRO-KLEAN cartridge is an infinite multiplicity of screens, ranging from relatively coarse on the outside down to 10 microns in the center. Because of MICRO-KLEAN'S graduated density in depth, particles are entrapped within the entire depth of the filter element, giving the cartridge a much longer effective life. Standard cartridge size is 9¾" long by 2¾" O. D., in densities of 10, 25 and 50 microns.

MICRO-KLEAN gives you

- **greater dirt holding capacity**
- **absolute protection against rupturing or channeling of the cartridge**
- **longer effective cartridge life**

REMEMBER . . . IF YOU CAN PUMP IT, CUNO CAN FILTER IT

M.3.C

CUNO

ENGINEERED FILTRATION

Removes More Sizes of Solids From More Kinds of Fluids

AUTO-KLEAN (disc-type) • MICRO-KLEAN (fibre cartridge) • FLO-KLEAN (wire-wound)

COMPACT, FULL-FLOW FILTRATION FOR HYDRAULIC SYSTEMS

Fewer cartridge changes necessary with MICRO-KLEAN filters

You don't need a complicated, bulky filter to keep contaminants out of your hydraulic fluids. Cuno MICRO-KLEAN's compact construction gives you full-flow filtration in space which would limit ordinary filters to by-pass service.

The high porosity and low pressure drop operation of MICRO-KLEAN filters permit this full-flow service on gravity, low pressure, or suction lines—with no loss in operating efficiency.

Cartridge replacement costs are generally cut in half, when MICRO-KLEANS are used. MICRO-KLEAN's graduated density-in-depth allows greater capacity for dirt accumulation within the micronic cartridge, giving twice the useful life of an ordinary filter element.

Cuno's exclusive method of felting fibres produces a cartridge of great structural strength, free from channeling or distortion and entirely unaffected by moisture or acids. The specially engineered construction of MICRO-KLEAN affords simplicity of installation and maintenance. Cartridges can be changed in a few seconds—only one nut has to be removed.

Send for Cuno's free filtration analysis form, have one of your engineers fill it out, and mail it to us. We'll let you know exactly what you need to take care of your filtration requirements efficiently and economically—without obligation. And take advantage of Cuno's unique "money-back" offer: if MICRO-KLEAN doesn't outperform any filter cartridge you have previously used, we'll send you *double* your money back. Send the coupon today for free MICRO-KLEAN bulletin. M.3.6

Cuno Engineering Corporation
Dept. 356C South Vine Street, Meriden, Conn.

I'm interested in your "money-back" offer. Please send me your filtration analysis form—and more information on MICRO-KLEAN.

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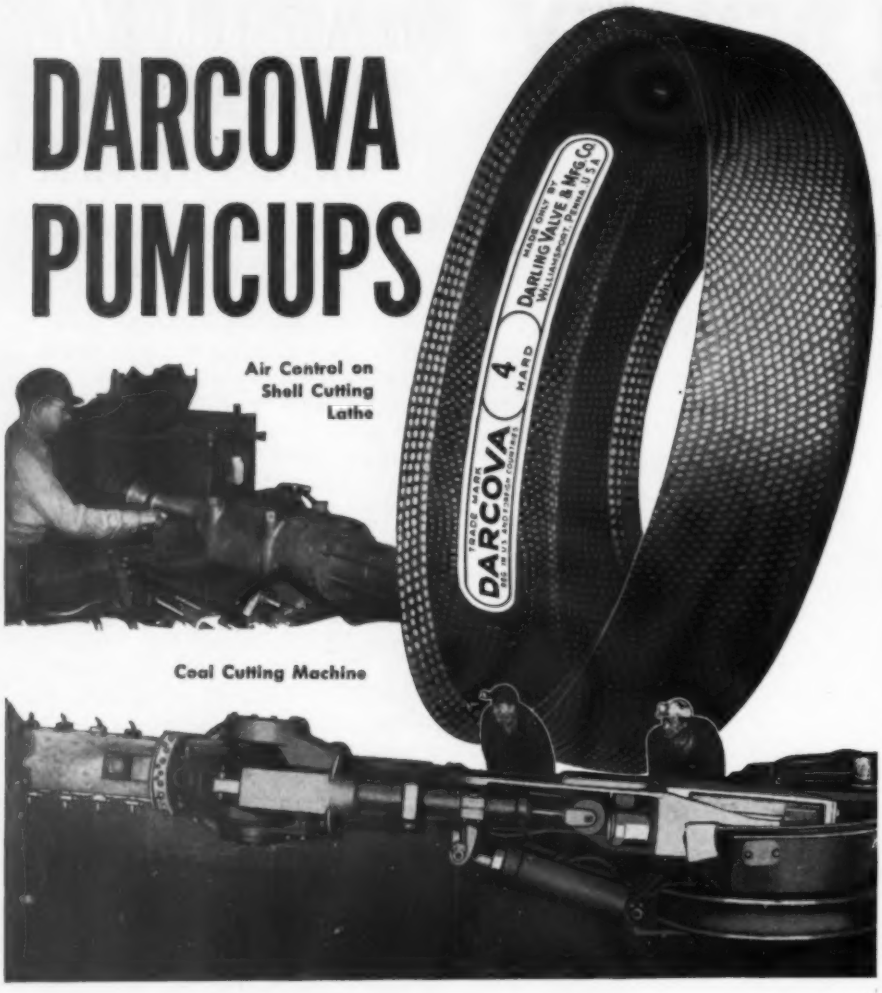
Circle 26 on Reader Service Card

DARCOVA PUMCUPS



The most efficient piston packing for air and hydraulic mechanisms

MORE and more plants are adopting Darcova Pumcups as the standard packing for air and hydraulic cylinders in machine tools, presses, hoists, lifts, rams, pusher mechanisms, controls, regulator valves, spraying equipment and various types of machinery . . . using air, oil, water and other fluids.

There are two basic reasons why Darcova Pumcups have proved to be more efficient: (1) Texture engineered Pumcups outlast most other piston packing at least 3 to 1. (2) Pumcups operate at full efficiency *throughout* their entire life span.

Fewer shutdowns, lower operating costs and longer cylinder life . . . are some of the advantages of Darcova Pumcups. Send for all the facts. Write for Bulletin No. 4502 on Pumcups for air and hydraulic mechanisms.

DARCOVA
THE ORIGINAL COMPOSITION CUP

DARLING VALVE & MANUFACTURING CO.
Williamsport 15, Pa.

PUMCUPS

Letters to the Editor

Continued

ating temperature 80 F; approximate composition: NaCl, 16.5; Na_2SO_4, 6.8; KCl, 4.8; Na_2CO_3, 4.8; and $Na_2B_4O_7$, 1.5 percents. We would appreciate any help you can give us.

L. H. CORNELIUS
Purchasing Agent
American Potash & Chemical Corporation
Los Angeles, Calif.

On the basis of the information you give, we believe that a hydropneumatic bag type accumulator would be the only type that would be practical. A special composition bag may be necessary. We suggest you consult with one of the manufacturers of this type accumulator, a list of which we have sent you.

Tubing for Cylinder Use

I would like to secure some information on suppliers who could furnish cylinder material for fabricating cylinders up to 10 inches ID, in bronze, steel tubing, chrome plated, ground and polished inside and steel tubing ground and polished inside.

J. D. PARRISH
General Foreman, Mechanical
B. F. Goodrich Chemical Co.
Port Neches, Texas

Such companies as Janney Cylinder Company, Philadelphia, and the Tube Reducing Company, Wallington, N. J., specialize in tubing for hydraulic cylinder applications in the sizes you specify. For your information also, the Koldflo Division, Mullins Manufacturing Corporation, Salem, Ohio, has recently begun to produce cylinder barrels and accumulator shells in some of the smaller sizes. A list of suppliers, from our current Directory issue, has been sent to you.

Hydraulic Cranking Systems

In the September issue of APPLIED HYDRAULICS I was very much interested in the description of a new hydraulic cranking system. Could you put us in touch

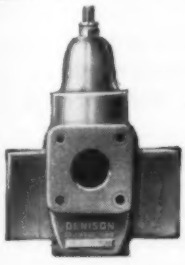
Continued on page 12

For lasting efficiency with less maintenance, specify

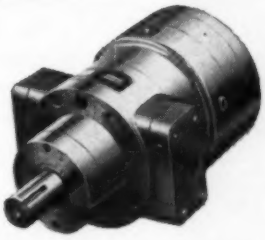
DENISON HydrOILic PUMPS, MOTORS, CONTROLS

For circuit pressures to 5000 psi

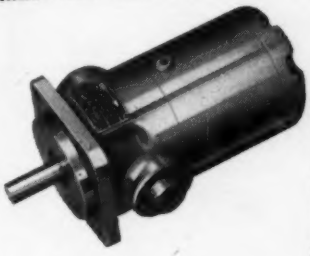
SURGE-DAMPING CONTROLS
Industrial and Aircraft Types
Eliminate Destructive Hydraulic Pressure Shock
¼" to 1" Sizes
For Pressures to 5000 psi
Catalog VS-1-A



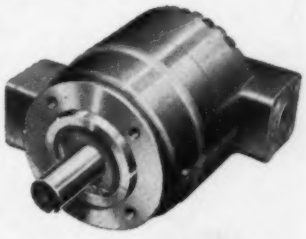
Direct-Operating PRESSURE CONTROLS
½" to 1½" Sizes
For Pressures to 2000 psi
Catalogs VRD-1 through VRD-8



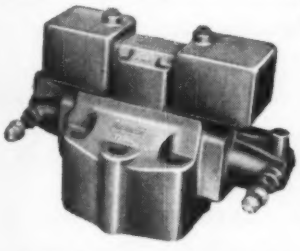
High-Pressure Axial-Piston PUMPS
Constant or Variable Volume
For 2500, 3000 and 5000 psi Circuit Needs
3.5 to 35 gpm Capacities
Catalogs P-4 through P-4-10



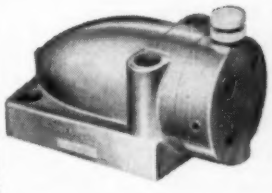
High-Torque Axial Piston FLUID MOTORS
Torque Ratings 13.8 to 112 inch-pounds per 100 psi (about 3 to 180 hp maximum)
For Pressures to 5000 psi
1500 to 3000 rpm
Catalogs FM-1, FM-2, FM-3-A



Dual-Purpose, Vane-Type PUMP/MOTOR
Ready for either pump or motor use without change
Shaft rotation in either direction
Four Sizes, 11 Models
Pumping Capacities: 3 to 82 gpm.
Motor Torque: 13 to 257 inch-pounds per 100 psi. Pressures to 2000 psi.
Bulletin P-5

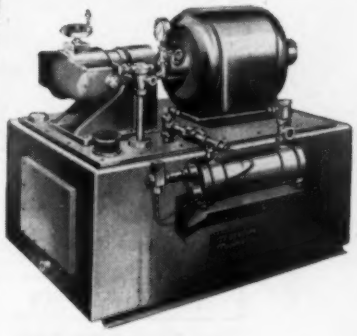


DIRECTIONAL CONTROLS
Manual, Mechanical, Electric or Pilot Control. ¼" to 2" Sizes
For Pressures to 5000 psi
Catalog VD-3



PRESSURE REDUCING VALVES
¾" to 1½" Sizes
20 gpm to 65 gpm Capacities
For Pressures to 5000 psi
Catalog VPR-1

Multi-Range FLOW CONTROLS
Full-Scale Regulation—Adjustable for Varying Input
¼" to ¾" Sizes
For Pressures to 3000 psi
Catalogs VFC-1, VFC-2



PUMPING UNITS
Constant and Variable Volume
46 Models—2 to 35 gpm Capacities
For Pressures to 5000 psi
Bulletins PU-3-A, PU-4 and PU-5

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under industry's toughest operating conditions

Denison HydrOILic Pumps, Motors and Controls are noted for their combination of high efficiency and rugged dependability.

In addition to fine performance under continuous, heavy-duty use, Denison HydrOILic Equipment offers space-saving design that simplifies circuit layout, makes installation easier, and minimizes maintenance problems.

Because so many users verify the extra value built into Denison Pumps, Motors and Controls, we continue the challenge made so often before—*let comparison prove to you* why they are first choice for so many needs of every type. Write today for full details on Denison HydrOILic Equipment to meet your requirements.

Pilot-Operated, Solenoid-Controlled DIRECTIONAL VALVES
Eliminate Spool-Sticking
¾" to 1½" Sizes, For Pressures to 5000 psi
Catalogs VD-1-1 to VD-4-2

Hydraulically Balanced PRESSURE CONTROLS
¾" to 2" Sizes
For Pressures to 5000 psi
Catalogs VR-2-B and VR-S-2

"The Finest Money Can Buy!"

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Small Valves?

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FLUID CONTROL SPECIALISTS

can solve your problem with all types and sizes

• Standard Types • Special Designs *for high vacuum conditions, high pressure conditions and corrosive fluids*

TEST & LABORATORY EQUIPMENT Needle valves with chrome or nickel finish; quick-opening valves for stopcock service; ball-type check valves in brass and stainless steel; high vacuum valves in toggle style, packless and needle types.

CORROSIVE FLUIDS Needle valves and toggle valves in several types of stainless steel; needle valves made from other alloys: aluminum, Monel, carbon steel; packless valves of diaphragm and bellows types, in several alloys.

INSTRUMENT AIR LINES Needle valves for direct panel mounting; toggle valves for on-off service with colored plastic handles for quick identification; valves for use with all types of tube fittings.

SPECIAL DESIGNS In many cases, our engineers can adapt standard valves to equipment manufacturers' special requirements.

Write for the New Hoke Catalog!

This completely illustrated 68 page catalog contains specifications on needle valves of all sizes as well as toggle valves, packless valves, special purpose valves, fittings and accessories. Tell us about your problem and we will gladly send you a copy of the catalog with our specific recommendations.

Address your request to 187 S. Dean St.

HOKE

HOKE INCORPORATED

Fluid Control Specialists

ENGLEWOOD, NEW JERSEY

Letters to the Editor

Continued

with the manufacturer of this equipment?

E. BJERG MORTENSEN,
Akts. Nordisk Venditor
Copenhagen, Denmark

The hydraulic cranking system you refer to is manufactured by Hydromotive, Inc., 2323 East 67th St., Cleveland 4, Ohio. While this company has no present plans for export, we suggest that you communicate your interest to them.

Pressure Compensated Flow Control Valves

We would like to know if the pressure compensated flow control valve discussed on page 114 of your July, 1953 issue is currently being produced. If so, we would appreciate the names of those firms from which it may be obtained.

LOREN C. SMITH,
Department of Contract Research
Wyandotte Chemicals Corporation
Wyandotte, Mich.

The pressure compensated flow control valve is a standard item with a number of hydraulic valve manufacturers. We are sending you a list of manufacturers of oil-hydraulic flow control valves.

Design Question on Cylindrical Accumulator

In your August, 1953 issue there is an article by John W. Overbeke titled "The Development of Cylindrical Piston Accumulators." In the drawing of a single shell cylindrical accumulator, Figure 4, page 59, two "O" rings are shown with an orifice between the rings leading back to the hydraulic fluid chamber. This orifice is put in to prevent a pressure trap between the two "O" rings. Neither the text nor the drawing indicates whether or not this orifice is ball checked to prevent the oil or hydraulic fluid from going directly to the second "O" ring at the top. The question is that if there

Continued on page 16

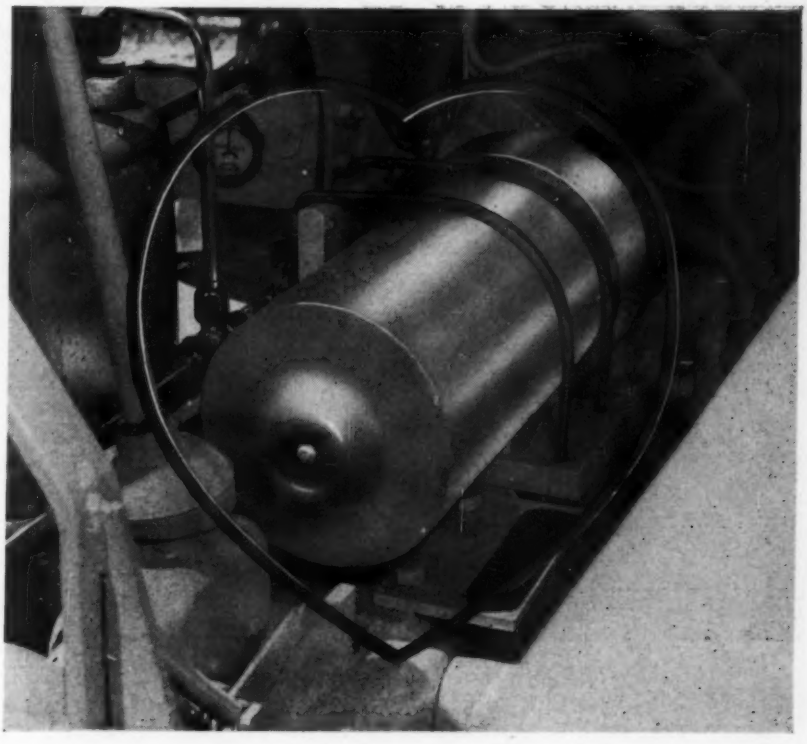
we needed a better

HYDRAULIC ACCUMULATOR

● The heart of our HYDROTOR Hydraulic Cranking System is the Hydraulic Accumulator . . . as important as the battery to an electrical system.

The high cost and inefficiency of commercially available accumulators induced us to develop and manufacture our own unit.

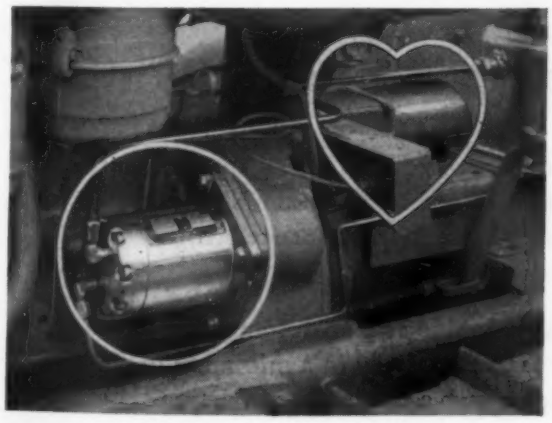
We solved our problem by combining a new process with a new design. The Accumulator shell and single cap are fabricated by the "Kold - Flo" Process★ providing a lighter, tougher shell with better surface characteristics. The inner shell surface provides perfect sealing throughout its entire length without machining.



Hydramotive Accumulators* have these extra advantages:

- HIGHER WORKING PRESSURES WITH LESS BULK AND WEIGHT
- MAXIMUM EFFICIENCY WITH LONGER SERVICE LIFE
- FEWER REPLACEMENT PARTS — LESS MAINTENANCE
- SUITABLE FOR ALL TYPES OF HYDRAULIC FLUIDS AND SERVICE
- LOWER COST

Guaranteed Indestructible under normal operating conditions



Model CM-1 Hydrotor installed on Oliver Model OC-3 Crawler Tractor

HYDROTOR® the *NEW* revolutionary hydraulic cranking motor

Manufacturers of gas and diesel powered equipment are incorporating our HYDROTOR Hydraulic Cranking Systems into their new models as standard equipment.

Hydrotor Hydraulic Cranking Systems are available with standard SAE pads to replace electric and pneumatic starters. Special mounting pads to suit your needs.

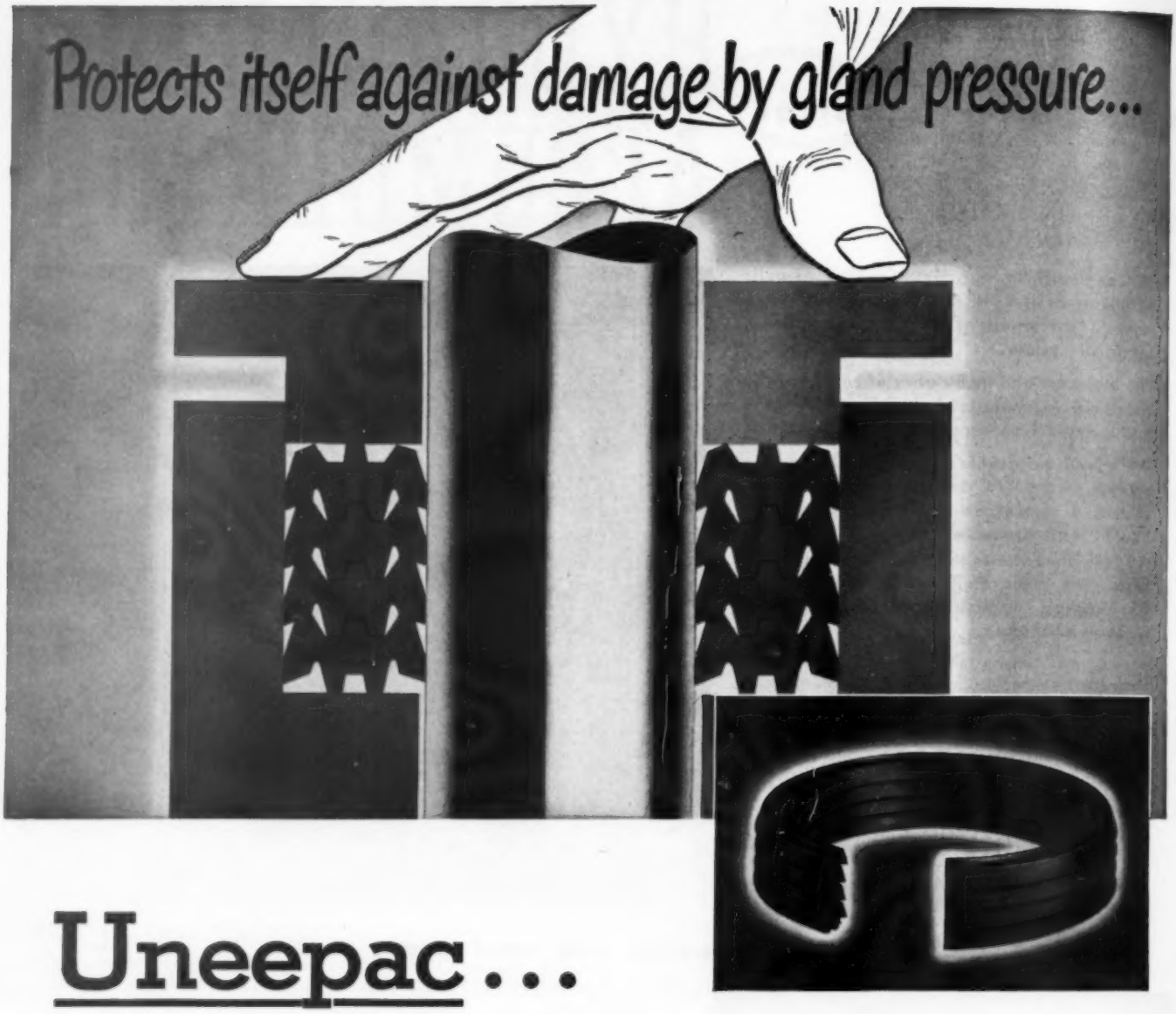
There is a Hydrotor for your requirements!

★Trade Mark of Mullins Mfg. Corp.
*Patents Pending

Write today for details on Hydramotive Accumulators or Hydrotor Cranking Systems.

HYDRAMOTIVE, INC.

2323 East 67th Street — Cleveland 4, Ohio



Uneepac . . .

the new Johns-Manville automatic ring packing

HERE AT LAST is an automatic ring packing that's designed to eliminate one of the most common causes of packing failures!

A glance at the cross section above will show you why. Note the projecting portions of the center section of each Uneepac ring. These projecting "legs" provide an effective safeguard against damage by excessive gland pressure. Header and follower rings are therefore seldom required.

Another important advantage is also provided by this unique design. Each Uneepac ring centers itself on the preceding ring so that the entire set is aligned vertically and nested perfectly. This feature practically insures trouble-free installation.

If you are looking for an automatic ring packing that seals effectively in a minimum of space . . . operates with a minimum of friction . . . and is instantly responsive to fluid pressure changes . . . you will want all the facts about Uneepac. Bulletin PK-58A is free for the asking. Just address Johns-Manville, Box 60, New York 16, New York.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville PACKINGS & GASKETS

Diversatility rides again in the new COMPLETE line of SPEED KING Valvair Solenoid Pilot Operated Control Valves

Valvair Speed Kings are small, light in weight, with a speed of 600 cycles per minute, and proven capable of 20,000,000 cycles and up.

The New Valvair Speed King line is complete — 3-way, 4-way, and 4-way-5-port (2-pressure), foot-mounted or sub-base manifold mounted; pipe sizes — ¼", ⅜", ½", ¾", 1". *Complete* — to fit almost innumerable applications. A precedent-breaker in size, weight, speed and endurance. Only one moving part. Non-corrosive materials throughout. Solenoid and pilot valve parts are totally enclosed, but easily accessible. *Get all the facts!*

VALVAIR CORPORATION *Affiliate: Sinclair-Collins Valve Company*
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Rely Upon Valvair DIVERSATILITY

Ask for Bulletin "A-12".

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LEATHER PACKINGS

Seal Better . . . Last Longer

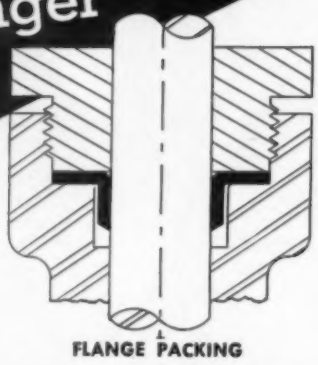
If you want an effective seal against glycerin, alcohol, mineral, fish and animal oils . . . water, vegetable, or any other non-caustic, non-acid fluid—use Tannate leather packings. These are a few of the mediums that can be sealed better, for longer periods, with Tannate packings than with any other common type of packing. And Tannate packings can be impregnated with special materials to suit individual requirements. Because they are "custom-manufactured" from raw hide to finished product, Tannate Packings seal better . . . last longer.

You get these advantages in Tannate Leather Packings: They have a low coefficient of friction; do not cold flow: will not score or abrade. They do not require lubrication, and they can be stored indefinitely without loss of tensile strength. Tannate packings are "custom-manufactured" to operate efficiently over a wide range of pressures and temperatures—from sub-zero to over 200° F.—and with different types of mediums.

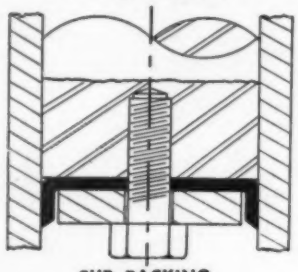
Send us your packing requirements for quotation. Include type, service, pressure, temperature, dimensions and quantity. There's no obligation. Do it today.

Write:

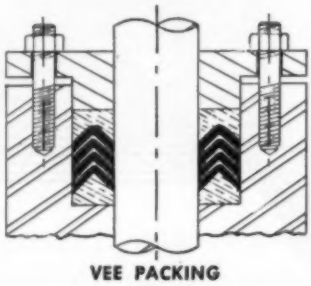
J. E. RHOADS & SONS
35 N. Sixth St., Philadelphia 6, Pa.



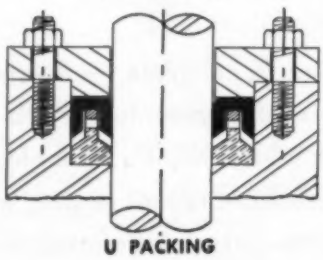
FLANGE PACKING



CUP PACKING



VEE PACKING



U PACKING

Send for the Rhoads Packing Data File.

RHOADS
INDUSTRIAL LEATHERS

PHILADELPHIA • NEW YORK • CHICAGO • ATLANTA

Letters to the Editor

Continued

is a check valve arrangement in this orifice so arranged to bleed out the pressure between the two "O" rings and yet not admit the hydraulic fluid chamber pressure directly through the orifice, what type of check valve is used? If there is no check valve arrangement in this orifice, of what value is the lower "O" ring?

In similar designs of hydraulic cylinders in our own application, we have used just such an arrangement; however, we have used a small ball check arrangement to bleed out the pressure trap between the two "O" rings and not admit the hydraulic fluid under pressure in this area. This means that whenever the pressure in between the two "O" rings is greater than the hydraulic fluid chamber pressure, the trap pressure bleeds back over the ball check valve into the hydraulic fluid chamber. Yet, at no time can the hydraulic fluid pass directly through the orifice to the second "O" ring. By using this type, we have successfully adapted two or more "O" rings on the same piston, thereby greatly reducing the amount of oil slip as both "O" rings are a definite sealing factor in this construction.

JOSEPH A. BOLDUC,
Chief Engineer
Lynn Manufacturing Co.

In answer to Mr. Bolduc's letter Mr. Overbeke says: "There is no ball check in the orifice. As Mr. Bolduc points out the function of the passage between the "O" rings is to prevent a pressure trap. The lower "O" ring is used to stabilize the piston. The "O" ring at the air end is the working ring in this design".

Editor's Note

In this column in the August issue, we noted that the new edition of the Compressed Air and Gas Institute Handbook would probably be ready in October. Our information now is that, due to extensive new material being added, that the expected publication date is late spring, 1954.

Continued on page 21

...with TYCOL lubricants on hand!

They "Combed" the Lube Field for the *Right* Hydraulic Oil!

A world-renowned plastics manufacturer – and a leading producer of fine-tooth combs – took plenty of time before specifying Tycol Aturbrio 60. With a world-wide product reputation and a half-century of experience they knew exactly what they wanted. Today Aturbrio is used exclusively in their Eastern plant for all hydraulic service – including Lester-Phoenix Injection Moulding machines with Vickers pumps. Tycol Aturbrio oils are unexcelled as turbine and electric motor oils . . . as well as hydraulic media. With maximum resistance to sludging and positive rust-inhibiting qualities – they're well worth your consideration. Just contact your local Tide Water Associated office!

TYCOL
INDUSTRIAL LUBRICANTS

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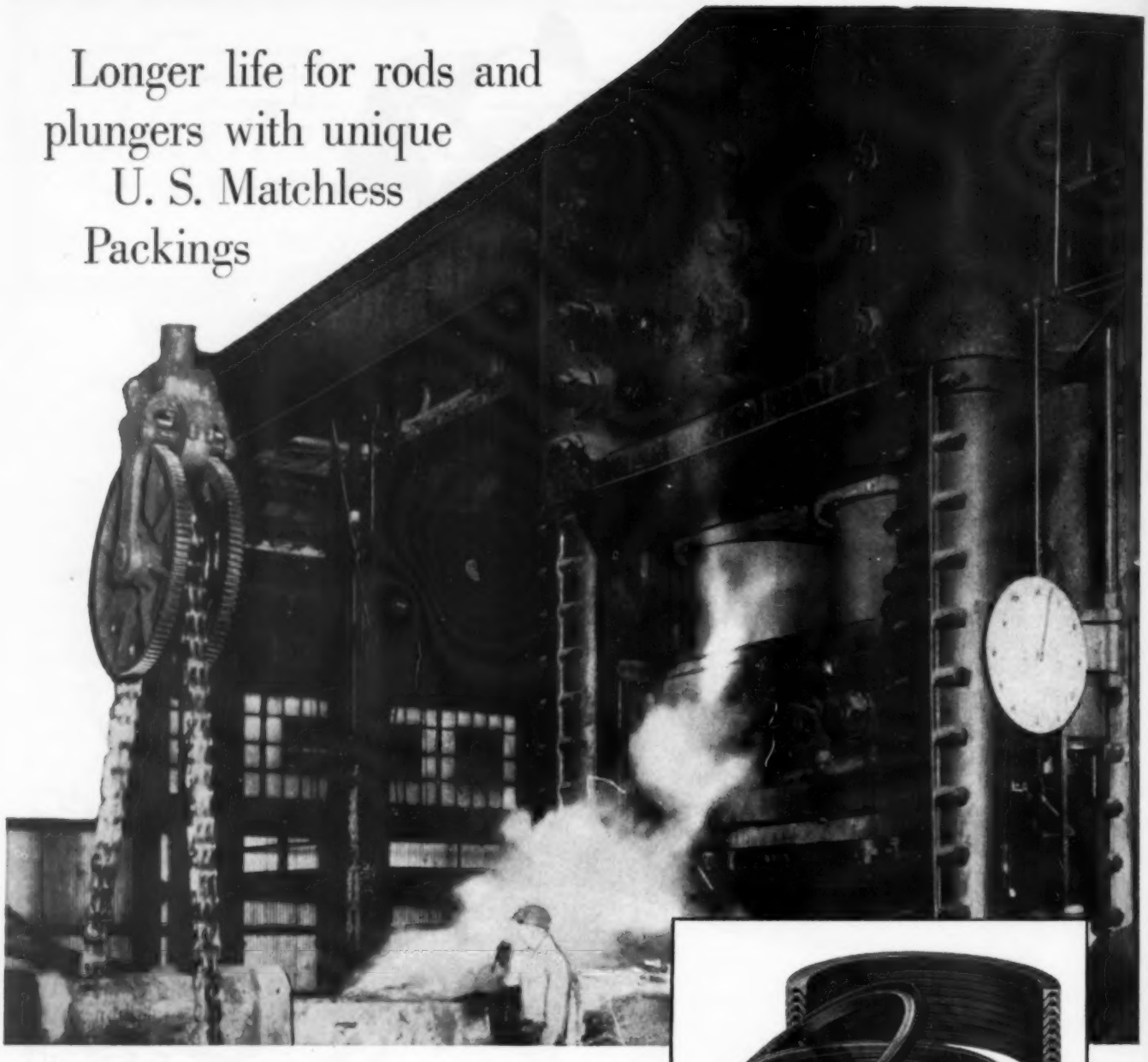
Over 300 Tycol industrial lubricants are at your disposal . . . engineered to fit the job!

TIDE WATER ASSOCIATED OIL COMPANY
17 BATTERY PLACE · NEW YORK 4, N. Y.

REFINERS AND MARKETERS OF VEEDOL . . . THE WORLD'S MOST FAMOUS MOTOR OIL

Circle 104 on Reader Service Card

Longer life for rods and plungers with unique U. S. Matchless Packings



U. S. Matchless Packing comes in 12 different styles, to handle pressures up to 8,000 lbs. per square inch.

No other packing has *all* these advantages:

- **Blunt edges**—provide uniform strength throughout.
- **Triangular spaces**—to trap loose scale, oil.
- **Pressure break**—provides faster, more effective action.
- **Molded end rings**—no sharp edges to break off.
- **Easy to install**—because of parallel (not flare type) side walls.

Matchless® Packing reduces wear and tear on rods and plungers, minimizes friction because it has a self-adjusting, automatic action. Designed for hydraulic equipment, presses, rams, triplex pumps and outside packed pumps. This *quality* U. S. Matchless Packing is stocked at any of the 25 "U. S." District Sales Offices—each staffed with engineers—and distributed by wholesalers everywhere. Or write to address below.

U.S.RUBBER
SERVING THROUGH SCIENCE

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What he's proving about pumps 15 MILES UP...

may hold an idea YOU can use

A shaft seal, for example, that stays vapor-tight even at —70°F. And at an atmospheric pressure only 1/30 that at sea-level.

Or pumps to handle low-boiling-point liquids, (like aviation gasoline), without troublesome vapor-lock or cavitation.

Or pumps to work at 1,000-pound pressure dependably in desert heat *and* Arctic cold.

* * * * *

These, and many other pumping problems have been solved by the Accessories Division . . . then *proved* in our High-altitude Lab. where engineers can "fly" a pump to 75,000 feet without ever leaving the ground.

Your pump requirements, present or future, can find a prompt solution from the broad experience the Accessories Division has had in aircraft fuel pump development. After all, Thompson Products is the leader in manufacturing pumps for aircraft and commercial production. Write us, describing your application.

ACCESSORIES DIVISION

Thompson Products, Inc.

DEPT. AY-12 • CLEVELAND 17, OHIO

TIME IS MONEY IN DISCHARGING BULK CARGO

WHY NOT SEE WHAT A *Hydromotor* CAN DO FOR YOUR PRODUCT OR JOB?

16 Standard Models with ratings from 150 inch-pounds at 100 p.s.i. to 230,000 inch-pounds at 1,000 p.s.i. Additional special sizes with substantially higher ratings are in limited production.

These 60 Bonnot Hydromotors—of 50,000 inch-pounds torque capacity each—are part of 240 recently delivered to one customer.

On bulk carriers, they will replace cumbersome mechanical equipment in the operation of bottom gates on heavy materials hoppers. They'll affect *surprising money savings in unloading time*, and being completely sealed and self-contained they'll *minimize operating and maintenance expense* caused by heavy loads, dampness, dirt and corrosion . . .

Using any hydraulic medium, the Hydomotor provides reciprocating rotary power . . . develops instant full torque in either direction through any arc up to 280°. With all the flexibility inherent in hydraulics equipment, the Bonnot Hydomotor may be stopped at any point, reversed, speeded up or slowed down by simple controls.

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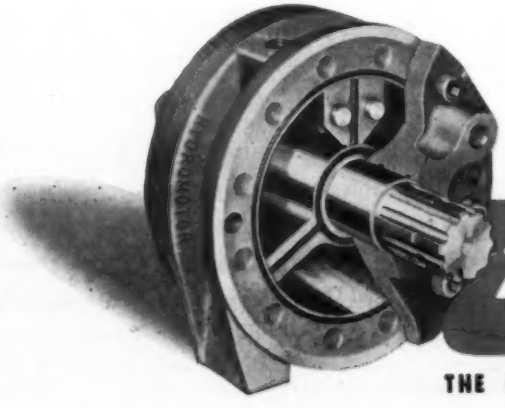


For application and engineering data, write for Hydromotor Bulletin #21.

Name of Local Agent on Request

Hydromotor DIVISION

THE BONNOT COMPANY • CANTON 2, OHIO

Letters to the Editor

Continued

NCIH Papers

Please advise how copies of papers presented at the recent sessions of the National Conference on Industrial Hydraulics and the National Fluid Power Association may be obtained.

E. A. SHERRILL
Engineering Department
Missile Section
Bendix Products Division
Bendix Aviation Corp.

Papers given at the recent National Conference on Industrial Hydraulics are not available for general distribution. However, copies may be available in some cases, direct from the authors. The entire set of papers will be published, as usual, in the Proceedings of the Conference. The Proceedings are expected to be ready for distribution shortly after the first of the year. Due to the nature of the National Fluid Power Association meeting, it is not likely that copies of most of the informal talks will be available. However, minutes of the meeting will be available, probably during December, from the executive secretary, Barrett Rogers, 1618 Orrington Ave., Evanston, Ill.

JIC Hydraulic Symbols

I wish to obtain a list of the Joint Industry Conference hydraulic symbols. Could you help me locate the proper source?

EDWIN F. SIBLEY
Waterford, Conn.

This letter was forwarded to us by Richard Tyler of Van Cleef & Co., manufacturers' representatives. Copies of the current edition of the J. I. C. Hydraulic Standards for Industrial Equipment may be obtained from Joint Industry Conference, Box 182, Northend Station, Detroit 2, Mich. For your information sub-committees on nomenclature and symbols of the Standards and Educational Committees of the newly formed National Fluid Power Association are preparing additional symbols for hydraulic components. We will announce in APPLIED HYDRAULICS when and how these additional symbols will be distributed.

Maintenance of Pumps and Valves

It would be very much appreciated if you could tell me where I could obtain a manual on the maintenance of all types of pumps and control valves, etc. of fluid power transmission. I have been doing repair work on such equipment as lift trucks.

LOUIS KOSTOLECKI
Palmer, Mass.

First, we would suggest that you ask your maintenance supervisor or engineering department for a set of data sheets, bulletins and catalogs on the types of lift trucks you have in your plant. Most manufacturers supply adequate published material on their lift trucks and their hydraulic circuits. It is good practice for the maintenance department to collect and hold in their own files all material that is directly useful to them in their

Continued on page 25

Sprague Shut Off Valves automatically cut out gages and other pressure-sensitive instruments when fluid pressures go beyond their operating limits. Automatically open when pressure is again within approx. 80% of set cut-out points. Available for any pressure setting between 10 PSI and 5000 PSI.

Save valuable man hours. Eliminate opening and closing manually operated shut off valves. Supplied with standard pipe thread connections, also available with AN tube fittings. Body is 1½" aluminum hexagon stock. Length 5½". Bronze or stainless steel bodies also available. Easy to install. Thousands in use. Write for bulletin.

SPRAGUE
Engineering and Sales Corp.
1144 WEST 135TH STREET, GARDENA, CALIFORNIA

Strength and . . . when you need Flexibility

The Strength of Steel, plus the Flexibility of Rubber, is built into WIRETEX. Designed specifically as a high-pressure conductor for use on hydraulically operated road, farm, materials handling, coal mining and oil machinery, dump trucks, busses, snow plows, lubrication and railroad equipment . . .

WIRETEX Hydraulic Control Hose may be just the answer to your present problem . . . and it's easy to select, too . . . our pocket-size Selector will give you the correct WIRETEX specification number from any known factor . . . send for yours today!

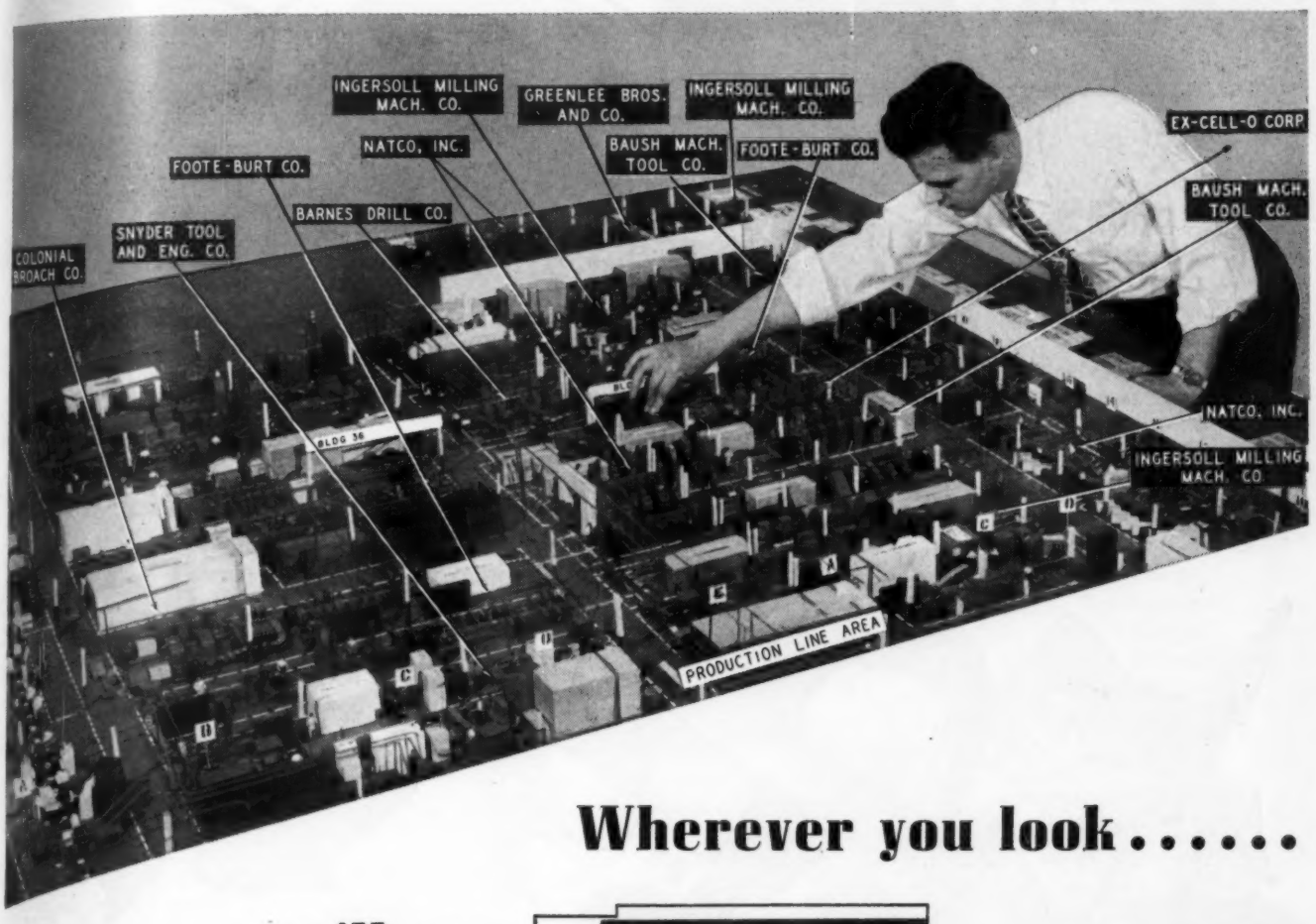
REPUBLIC RUBBER DIVISION

LEE RUBBER & TIRE CORPORATION, YOUNGSTOWN 1, OHIO

INDUSTRIAL RUBBER PRODUCTS

Circle 89 on Reader Service Card

In this Modern Automobile Engine Plant



Wherever you look.....

you'll see VICKERS® HYDRAULICS

Here is a scale model of the production line area of one of the most modern automobile engine plants ever built. Having a capacity of 100 V8 engines per hour, it is equipped with time-and-money-saving machinery for automation.

Wherever you look in this plant you'll see Vickers Hydraulics. This is indicated on the photograph by the lines leading out from the Vickers-equipped machines to the names of their makers. It is an interesting study . . . first for the variety of machines . . . second for the large number of builders who use Vickers Hydraulics. Vickers Hydraulics is often the ideal solution to the myriad problems of feed, control, transfer, synchronization, etc. which must be dealt with in a highly automatized plant such as this. Hydraulic power can be developed wherever most convenient and applied at any other location. Simplification of design, flexibility of control, instantaneous response, rapid operation, ease of providing interlocks and overload protection, low maintenance . . . all are characteristics of Vickers Hydraulic Systems.

Do your machines have Vickers Hydraulics? The Vickers Application Engineer near you will be glad to discuss the many advantages.

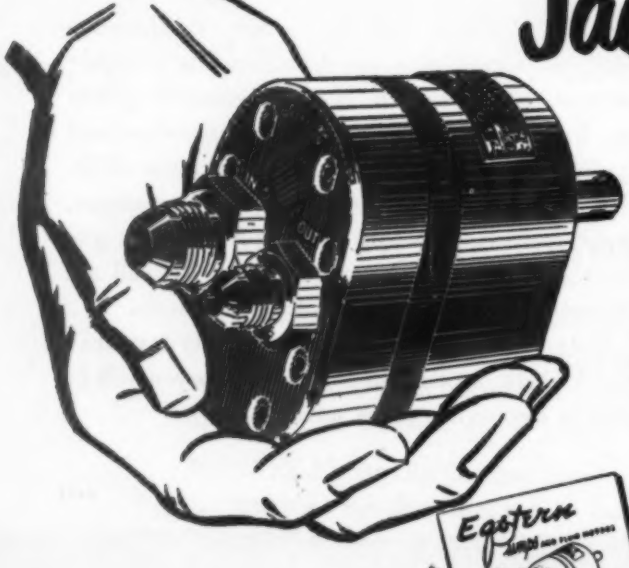
6445

VICKERS Incorporated
DIVISION OF THE SPERRY CORPORATION
1474 OAKMAN BLVD. • DETROIT 32, MICH.

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

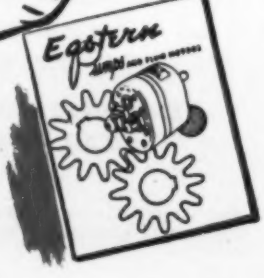
Application Engineering Offices: ATLANTA • CHICAGO (Metropolitan) • CINCINNATI • CLEVELAND • DETROIT • HOUSTON • LOS ANGELES (Metropolitan) NEW YORK (Metropolitan) • PHILADELPHIA (Metropolitan) • PITTSBURGH • ROCHESTER • ROCKFORD • SEATTLE • TULSA • WASHINGTON • WORCESTER

Jack the Giant Killer



Jack found the best way to slay the giant was with a sharp axe. The solution to industry's giant problem — cutting production costs — involves using a great many axes. One way to help conquer *this* giant is to substitute small equipment capable of doing a big job.

Eastern HYDRAULIC PUMPS and FLUID MOTORS are giant killers in their own right. In many installations they replace more expensive units many times as bulky. Keeping size and weight to a minimum, they help cut operating costs wherever they are applied.



EASTERN INDUSTRIES, INC.

296 ELM STREET • NEW HAVEN 6, CONN.

● *To see if one of these units might be your "hen that lays the golden eggs", write for Eastern Bulletin D-800 today.*

Letters to the Editor

Continued

work. The best all around manual that we believe you would find useful is the "Hydraulics" book prepared as a text in the Ford Trade School. This manual was recently taken over by Vickers, Inc., who are in the process of revising and enlarging it. Copies of the present manual are available from the Product Service Department, Vickers, Inc., 1474 Oakman Blvd., Detroit 32, Mich. at $2.00 per copy.

High Pressure Lubricator for Air Lines

We would appreciate your advice as to where we might obtain the following item: lubricator or oiler for an air line for operation at 800-1000 psi working pressure, ¾ inch size, automatic-gravity feed with sight-feed glass, one pint (or more) capacity for use with a very light oil, similar to separator oil.

A. G. HARVEY,
Purchasing Department,
The Cleveland Pneumatic Tool Co.,
Cleveland, O.

We do not know of such a unit now being produced. It probably would have to be built special. We suggest you write several of the companies on the list sent you.

Hydraulic Circuit Design

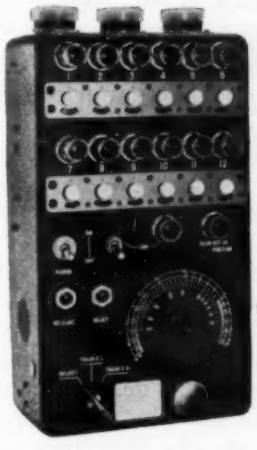
I am interested in finding a book or manual, preferably of recent publication, that would have detailed hydraulic system designs with complete descriptions of operation of systems and each individual component.

D. C. CARD
The C. S. Card Iron Works Co.
Denver, Colo.

We know of no manual that would fit your requirements exactly. There are two excellent manuals on the professional engineering level that you would find useful. These are "Oil Hydraulic Power and Its Industrial Applications" by Walter Ernst and "Fluid Pressure Mechanisms" by H. G. Conway. On the shop maintenance level the best book we know is "Hydraulics" a text used in the Henry Ford Trade School.

NEWMATICS

RHODES LEWIS ELECTRICAL CONTROL BOXES CUSTOM MADE TO YOUR SPECIFICATIONS



Electrical control box units centralize and coordinate the management of remote equipment. Rhodes Lewis specializes in the design of compact light-weight control box units that require minimum installation effort. Typical innovations of Rhodes Lewis designs include: Edge-lighting for panel illumination without additional light source; intervalometer for continuous impulsing with a variable time interval of 7 to 120 seconds.

See Rhodes Lewis for these new light-weight products and systems

ITEM	Used in high-pressure pneumatic systems	Used in low-pressure pneumatic systems	Other aircraft applications
AC & DC Compressors	X	X	
Hydraulically Driven Compressors	X	X	
Bleed Turbine Compressors	X	X	
Fiberglass Pneumatic Receivers	X	X	
Electrical & Electronic Control Systems			X
AC & DC Motors	X	X	X
Small Accessory Turbine Drives	X	X	X
Pneumatic Valves, Operated Electrically or Mechanically	X	X	
Solenoids, Intermittent or Continuous Duty	X	X	X
Pneumatic Ejection Systems	X	X	

Take advantage of Rhodes Lewis engineering knowledge and manufacturing facilities to design and produce control box units to meet your requirements. Your inquiries are cordially invited.

9-3301

RHODES LEWIS CO.
Subsidiary of McCulloch Motors Corporation
6151 W. 98th Street,
Los Angeles 45, California

McCULLOCH

ELECTRIC PNEUMATIC ENGINEERS · MANUFACTURERS

NEW PRODUCTS

Components, tools and equipment designed to improve operation of fluid power systems are described here . . . for more information fill in and mail the post card bound in this issue.

INDUSTRIAL GASKET
. . . resists spiral twisting

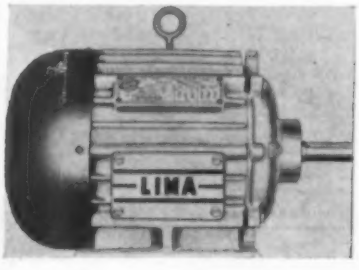
Designation: Quad-Ring

Design: The ring has four sealing surfaces, compared with the two sealing surfaces of an "O" ring. It is specifically designed as a replacement in applications where "O" rings have failed to seal properly.

Applications: Applications have given long life. Chief reason for this, is that deformation caused by hydraulic pressure is lessened through this design. Shape of the ring fills the packing groove without the distortion necessary for a perfect seal using "O" rings. Excellent sealing properties under low pressure, especially under 8 psi, fit the ring for versatile application. Similar performance is characteristic under extremely high pressures as well. The rings are interchangeable with "O" rings. They are produced in a complete line of sizes and are comparable to "O" rings in wall thickness and diameter. All grooved dimensions are same as for "O" rings.

Minnesota Rubber and Gasket Co., Minneapolis 16, Minn.

Circle 231 on Reader Service Card



FAN COOLED MOTOR
. . . is totally enclosed

Designation: Type E

Ratings: ¾ hp at 900 rpm to 20 hp at 3600 rpm in NEMA frame sizes 224 to 326 inc.

Features: Rigid, seasoned cast iron frames with integral feet. Deep, integrally cast fins providing heat dissipating surface resulting in cooler operation. Double-width prelubricated sealed ball bearings require no greasing or cleaning for normal life. The correct quantity of lubricant is sealed in, keeping dirt and moisture out. A specially designed cast aluminum fan provides high velocity air over the cooling fins.

The Lima Electric Company, Lima, Ohio

Circle 232 on Reader Service Card

SOLENOID VALVES
. . . are explosion proof

Design: Standard voltages are 115 or 230 ac, 60 cycles and 115 v. dc.

Features: Midget 2-way and 3-way solenoid valves have explosion proof solenoids. Solenoid enclosures are of cast iron, with ½ in threaded conduit connections. Conduit boxes can be revolved 360 degrees.

Application: Two-way valves are available normally closed for shut-off, adjustable main flow and adjustable by-pass service and also for normally open shut-off duty. This valve is very compact being only 3 in. high and 2-19/32 in. in over-all width. The three-way type valves may be applied to any three-way valving requirement regardless of the direction of flow or points of application of pressure. The standard valve without any change of springs or other adjustments is suitable for any type of three-way control application.

Automatic Switch Company, Orange, New Jersey

Circle 233 on Reader Service Card

For more New Product Information turn to page 112

MORE AND MORE MANUFACTURERS ARE INSTALLING
MARVEL SYNCLINAL FILTERS
AS STANDARD EQUIPMENT

Manufacturers of hydraulically actuated equipment and others with low pressure liquid circulating systems demand their equipment to perform consistently and with all the productive efficiency they build into the machine that bears their name. Since these systems must be kept free of damaging particles, the selection of a filter is an important factor. Here are some of the outstanding reasons for the increasing preference for Marvel Synclinal Filters to do this all-important job!

SUMP TYPE
(Cutaway)

BECAUSE . . . Marvels are designed to give maximum ACTIVE filtering area rather than total filtering area. Only ACTIVE FILTERING AREA COUNTS!

BECAUSE . . . Marvels greater storage space for filtered out particles allows longer periods of "production" time at absolute minimum in maintenance cost and "down-time".

BECAUSE . . . Marvels can be disassembled, cleaned and reassembled by any workman in a matter of minutes.

BECAUSE . . . Marvels (Both Sump and Line Type) operate at full efficiency in any position. Line type may be serviced without disturbing pipe connections.

BECAUSE . . . Marvels are protected and of sound construction to give long life and efficient filtration.

BECAUSE . . . Marvels (Both Sump and Line Type) are available in individual capacities from 5 to 100 G.P.M. and choice of mesh sizes ranging from coarse 30 to very fine 200, they get a filter to fit their specific requirements.

BECAUSE . . . Marvel not only delivers a top grade filter in both quality and performance, but delivers IMMEDIATELY—shipments are made the same day orders are received, if desired.

LINE TYPE
(Cutaway)

FACTS NOT CLAIMS

Engineers decide on the basis of the record, on the basis of measurable facts rather than claims of the "campaign promise" variety. Here is a fact with meaning:

OVER 400 MANUFACTURERS MAKE MARVEL SYNCLINAL FILTERS THEIR O.E.M. CHOICE

For Dependable Protection On All Hydraulic And Low Pressure Systems Investigate MARVEL SYNCLINAL FILTERS

WATER FILTERS

In response to the great demand, we have adapted both our sump and line models for use in all water filtering applications. No changes have been made in the basic synclinal design.

MARVEL *Engineering Company*

625 WEST JACKSON BLVD., CHICAGO 6, ILLINOIS
Phone—Franklin 2-4431

COUPON

Marvel Engineering Company AH-12
625 W. Jackson Blvd., Chicago 6, Ill.

Without obligation, please send me complete engineering data on Marvel Synclinal Filters as follows—

Catalog #106 for Oil Filters
Catalog #300 for Water Filters

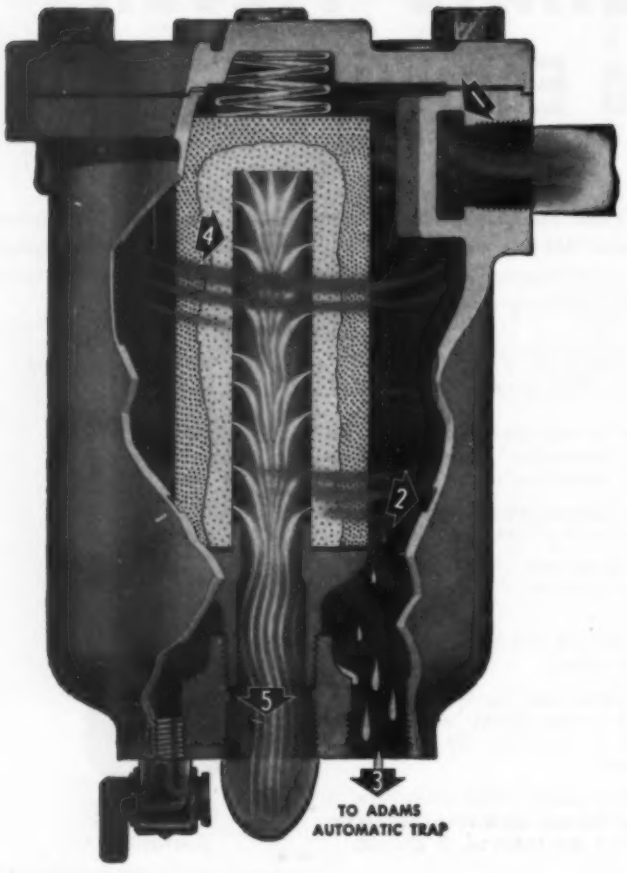
Name .....

Company .....

Address .....

City ..... State .....

ADAMS *has both* *



—— BOTH ANSWERS TO THE PROBLEM OF KEEPING WATER, WATER VAPOR, OIL AND DIRT OUT OF COMPRESSED AIR LINES

There's no *one* answer to this problem! The most expensive aftercooler you can buy will not remove scale that is picked up in the distribution lines. The most expensive air filter you can buy cannot guarantee removal of water vapor until it has been condensed by cooling. That's why Adams makes both.

* PORO-STONE *AIR FILTER*

1. Centrifugal separation of dirt and liquids.
2. Drainage to trap directed by vertical cast-in slots.
3. Continuous, fully automatic trap action.
4. Rapid diffusion and filtration through permanent, cleanable Poro-Stone.
5. Clean, dry air at practically unchanged pressure. Standard, stocked sizes handle from 10 to 700 cfm.

Easily installed in either vertical or horizontal pipe line.

*AFTERCOOLER AND CYCLONE SEPARATOR

Cools air to within a few degrees of cooling water, making certain that compressed air is colder than surrounding atmosphere, so that no further condensation can take place.

Counter flow, air-through-tube design assures continuously high heat transfer rate.

Double cyclonic action deposits all water and entrained oil in moisture chamber.

R. P. ADAMS CO., INC.
249 E. Park Drive, Buffalo 17, New York

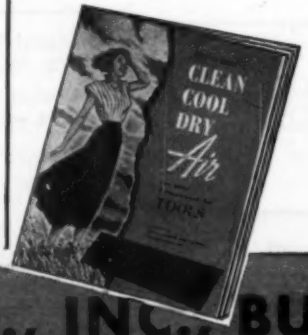
Please send me your latest literature, Bulletin No. 176 on BOTH the Poro-Stone air filter and the Adams Aftercooler — Cyclone Separator.

Name.....

Company.....*Title*.....

Address.....

City.....*State*.....



FOR YOUR PROFIT'S SAKE
— FIND OUT ABOUT BOTH

R. P. ADAMS CO., INC., BUFFALO 17, N. Y.

Circle 3 on Reader Service Card

Greatest Giant
in Lockheed Aircraft's
"Hall of Giants" is this 8000-ton
Birdsboro deep-draw press...
the largest of its type in the world.
Its big main rams, in keeping with
their advanced design, are sealed
with LINEAR VEE-DAM Rings,
the most effective modern hydraulic
packing ever developed!

Cross sectional view

Foolproof to assemble
Leakproof in operation

LINEAR VEE-DAM RINGS

The unique design of LINEAR VEE-DAM Rings makes possible, for the first time, a split "V" ring packing that is really leakproof . . . ideal for hydraulic presses, pumps and pneumatic equipment.

A look at the close-up view of a VEE-DAM Ring will tell you why they seal so effectively. Those sturdy rubber dams, faced in opposite directions, are moulded into the groove hinge area of the ring, completely eliminating leakage between rings.

VEE-DAM Rings are easier to install because they don't demand the precise fitting that ordinary rings should have. And they last longer, too, because they seal perfectly tight with a minimum gland load.

Made of a choice of fabric reinforced synthetic rubbers, LINEAR VEE-DAM Rings are individually engineered for your application. Write or call LINEAR for complete information.

"PERFECTLY ENGINEERED PACKINGS"

LINEAR

LINEAR, Inc., STATE ROAD & LEVICK ST., PHILA. 35, PA.

Circle 64 on Reader Service Card

Compactness

IS THE RULE ON ALL

Pathon

SERIES R H 2000 P.S.I. and SERIES Q H 1000 P.S.I. HYDRAULIC CYLINDERS

On all of your hydraulic cylinder applications the appropriate Pathon cylinder will give you the minimum in mounting size with increase strength and fatigue life.

A PATHON HYDRAULIC CYLINDER HAS...

LOW STRESS CONCENTRATION through the head to barrel attaching area providing a plus factor for shock loads. The single screw thread attaching method gives maximum strength in minimum space.

Our new thirty-two page bulletin covering these cylinders is now being distributed. Write for your copy.

Pathon
MANUFACTURING CO.

3823 PACIFIC AVE.
CINCINNATI 12, OHIO

AIR CYLINDERS...HYDRAULIC DIRECTIONAL CONTROL VALVES...HYDRAULIC CYLINDERS

Announcing the 1954

APPLIED HYDRAULICS PRIZE CONTEST

$1200 in Cash Prizes

Awards

FIRST PRIZE	$500.00
SECOND PRIZE	$300.00
THIRD PRIZE	$200.00
Fourth, Fifth, Sixth & Seventh Prizes, ea.	$ 50.00

WHO's ELIGIBLE?

Every reader of APPLIED HYDRAULICS is eligible.—product designers—machine builders—machine designers—maintenance men—industrial and tool engineers—plant supervisors—sales engineers.

WHAT MATERIAL SHOULD BE SUBMITTED?

Along with the typewritten text, include photographs and drawings. Drawings can be prints or sketches.

WHAT SUBJECTS ARE ACCEPTABLE?

Any topic which pertains to fluid power—pneumatics or hydraulics. It can be about design, maintenance or production. Read the winning papers in the 1953 contest. They're a good guide.

HERE'S HOW TO ENTER—

Write us today for an entry blank. We'll also send you suggestions which will help you prepare your article. Don't miss your chance to win a cash award.

The closing date for the APPLIED HYDRAULICS PRIZE CONTEST is June 1, 19

Engineered to fit your Hydraulic Systems...

. . . 500 Series

PUMPS

Among the 185 stock pumps offered by Brown & Sharpe you'll usually find one that meets your needs. For example, this 500 Series—for hydraulic installations—gives you a choice of six convenient sizes with capacities up to 37.6 gpm. and up to 500 psi. pressure . . . saves you the cost, time, and trouble of special engineering.

Features of the 500 Series Pumps include: quiet, efficient, heat-treated gears designed to reduce end thrust; long-wearing needle bearings; oil-tight, ground, housing joints; reversible back-drain allows changing direction of rotation; suction and discharge ports on ends and sides of pumps provide convenient piping combinations; adaptable flanged stand that meets practically all mounting needs. Write for complete, 32-page, Pump Catalog. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

Brown & Sharpe B·S

BUY THROUGH YOUR LOCAL DISTRIBUTOR

Dumping a Problem—

with this RIVETT Unloading Valve!

The output of both the low pressure high volume pump (2) and the high pressure small volume pump (1) is directed to the hydraulic cylinder at a low operating pressure. When sufficient work load builds up, pressure in the system increases and the Model 8826 pilot operated unloading valve unloads the output of pump (2) while the output of pump (1) is still directed to the cylinder. Direction of piston travel is controlled by Model 5170 hand operated 4-way control valve.

ANY unloading difficulty you might encounter in planning a high and low pressure circuit can be solved by use of the Rivett Model 8826 Unloading Valve. It is employed in oil hydraulic circuits to unload one part of the circuit at no back pressure to the tank, and is operated by pilot pressure from some other part of the circuit. Free flow to tank continues as long as the pilot pressure is higher than the setting of the valve. Available in sizes ¼" to 1½", in two pressure ranges, adjustable from minimum to maximum in each range. RIVETT LATHE & GRINDER, INC., Dept. AH-12 Brighton 35, Boston, Massachusetts.

RIVETT CATALOG NO. 204 IS A *MUST* FOR YOUR FILE!
28 pages illustrate and describe all types of hydraulic valves.

WHEN YOU APPLY HYDRAULIC OR AIR POWER *Plan with*

RIVETT

Air and Hydraulic Valves and Cylinders, Hydraulic Power Units.

USEFUL LITERATURE

You'll find many valuable production and design ideas in publications described here . . . copies will be sent you free without obligation

HYDRAULIC COMPONENTS . . . The Hydraulic Power Division of The Hydraulic Press Mfg. Co. has released nine individually bound catalogs for quick and easy reference to their line. They are, Catalog No. 601-Pump, Motors, Power Units and Accessories; Catalog No. 701-150 psi Air or 300 psi Oil Hydraulic Cylinders; Catalog No. 721-2000 psi Cylinders; Catalog No. 741-3000 psi Cylinders; Catalog No. 801-2000 Valves-Threaded Connections; Catalog No. 821-3000 psi Valves-Flange Connections; Catalog No. 841-3000 psi Sub-plate Connection; Catalog No. 901-Accessories and Catalog No. 1001-H-P-M's Engineering Manual. The cylinder catalog gives complete engineering data on over 800 basic models. From one set of catalogs an engineer can lay out a hydraulic circuit to meet almost any requirement.

Circle 175 on Reader Service Card

RELIEF VALVES . . . A new line of pilot type relief valves is detailed in two catalog sheets issued by Fluid Controls, Inc. Many features are described in regard to use, operation, pressures and capacity. The literature is set up so that one Catalog Sheet No. 1.20 describes the application, design and operating characteristics. The second Sheet No. 1.22 details such construction features as size, weight and capacity, both in standard pressure adjustment screw and hand knob pressure adjustment.

Circle 176 on Reader Service Card

PACKINGS . . . Folder #853 prepared by Hamilton Rubber Mfg. Corp., contains informative data on industrial rubber sheet packing covering items such as weight, tensile and hardness of rubber sheet stocks. Data on oil and solvent resistant sheet packings and piston or rod packings, is complete.

Circle 177 on Reader Service Card

HEAT TRANSFER PRODUCTS . . . A new 4 page, 2 color Catalog No. 353 features heat transfer products for chemical, industrial and oil field applications has just been issued by the Young Radiator Company. Included in the catalog are engine jacket water coolers, combination cooling units, supercharger air intercoolers, evaporative coolers and condensers, shell and tube heat exchangers, heating and cooling coils, unit oil coolers and steam condensers. Each unit i represented pictorially and accompanied with descriptive product information.

Circle 178 on Reader Service Card

PACKINGS . . . A Catalog No. M-3105, on the proper installation and care of packings, has been published by the mechanical goods division of the United States Rubber Company. In addition to information concerning what packings should be used on various installations, the catalog contains metric engineering tables and conversion charts for both centigrade and fahrenheit temperatures. There is also helpful material on maintenance for rod and plunger packings and gaskets. A complete chart is included on the chemical resistance of gasket materials as well as tables on melting points and specific gravity of various materials. The booklet consists of 112 pages and includes a convenient 4 page index.

Circle 179 on Reader Service Card

HYDRAULIC CYLINDERS . . . A two color bulletin prepared by Mullins Manufacturing Corporation, has been released. Bulletin No. 2 tells the inside story of how the required surface is created by the process that forms the cylinder. Finishing is not, therefore, a separate operation. A complete description of the process is told together with many advantages obtained with its use. Top and bottom cylinder variations are outlined, together with a comparison of this company's cylinder with a conventional type construction.

Circle 180 on Reader Service Card

BOLT OR STUD SEAL . . . A new sealing device for sealing of bolts and studs at either high or low pressure gas, liquids or air is presented in an Engineering Data and Specification Bulletin AC 14, offered by Franklin C. Wolfe Co., Inc. Sizes of the seals and features are outlined. These seals eliminate the necessity for sealing compounds and the seals can be re-used.

Circle 181 on Reader Service Card

For more reviews of recent literature turn to page 120

Circle 32 on Reader Service Card

SAFEGUARDING INDUSTRY'S *Lifelines of Mobile Power*

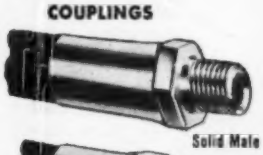
specify

Eastman
first in the field

HYDRAULIC HOSE ASSEMBLIES

for the best performance, for long life and satisfaction—*all along the line*—from manufacturer to user. Check your needs on the following list:

COUPLINGS



Solid Male

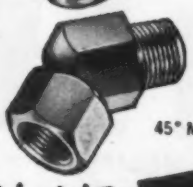
Swivel Male

Swivel Female

STRAIGHT AND ANGLED ADAPTER UNIONS

Straight Male

90° Male



45° Male

Write

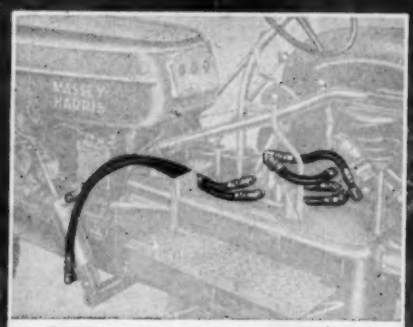
for free catalog 103 on Eastman Hose Couplings and Bulletins 231B & 232B on Straight and

how *Hydraulic power* delivered throug

Eastman
first in the field

HYDRAULIC HOSE ASSEMBLIES

helps "KEEP 'EM DOWN ON THE FARM!"



EASTMAN Hydraulic Hose Assemblies on Massey-Harris Tractor.

Thanks to hydraulic power, many a man's job on the farm is a boy's job now! Fingertip hydraulic control does away with aching arms, dog-tired from day-long tugging at levers to raise and lower tillage tools.

Massey-Harris, shipping agricultural tractors and implements to 106 countries the world over, has developed some of the most ingenious hydraulic controls to meet the needs of modern contour farming—controls which not only do most of the hard work—*but do it automatically!*

EASTMAN Hydraulic Hose Assemblies carry oil at 1000 psi from the Massey-Harris 2-Way, 2-Speed *"Depth-O-Matic"* Hydraulic Control to raise and lower tractor mounted implements smoothly, easily, swiftly. Synchronized slave cylinders handle harrows, discs, plows.

Massey-Harris *"Selective Control"* maintains uniform cultivator penetration on hillside contour slopes, pictured above, through independent action of right and left gangs. *"Delayed Action"* permits raising front and rear gangs independently at contour points, also permits shovels to leave and enter soil at same point at ends of rows.

Other users of EASTMAN Hydraulic Hose Assemblies in the agricultural field include: Allis-Chalmers Mfg. Co.; J. I Case; John Deere Co.; The Farmhand Co.; Harry Ferguson, Inc.; Horn Manufacturing Co.; International Harvester Co.; Minneapolis-Moline Co.; Ottawa Steel Products Co.; Super-Six Manufacturing Co.; A. F. Wagner Iron Works.

Look to EASTMAN—first in the field—for continued leadership in "Safeguarding the Lifelines of Mobile Power"—in Industry and Agriculture!

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- 11 standard mountings—more than 65 combination mountings
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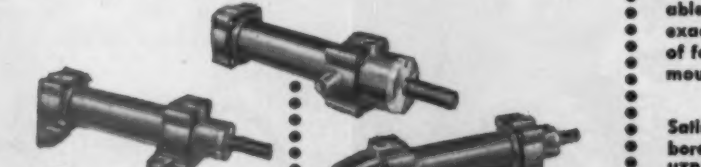
- Double end piston rods available in most styles
- Bodies of heavy-walled steel tubing "TRU-BORED" and honed



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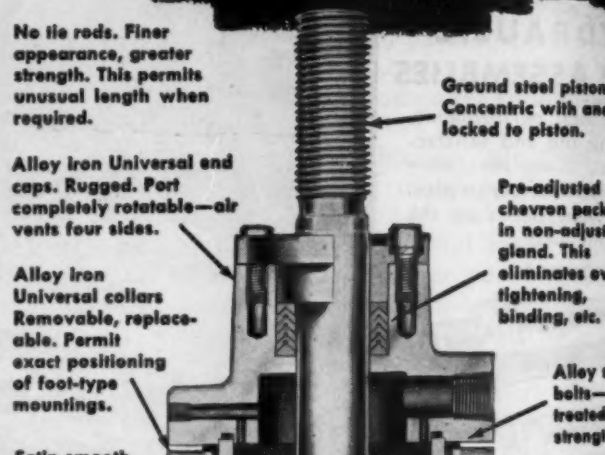

No tie rods. Finer appearance, greater strength. This permits unusual length when required.

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Alloy iron Universal collars Removable, replaceable. Permit exact positioning of foot-type mountings.

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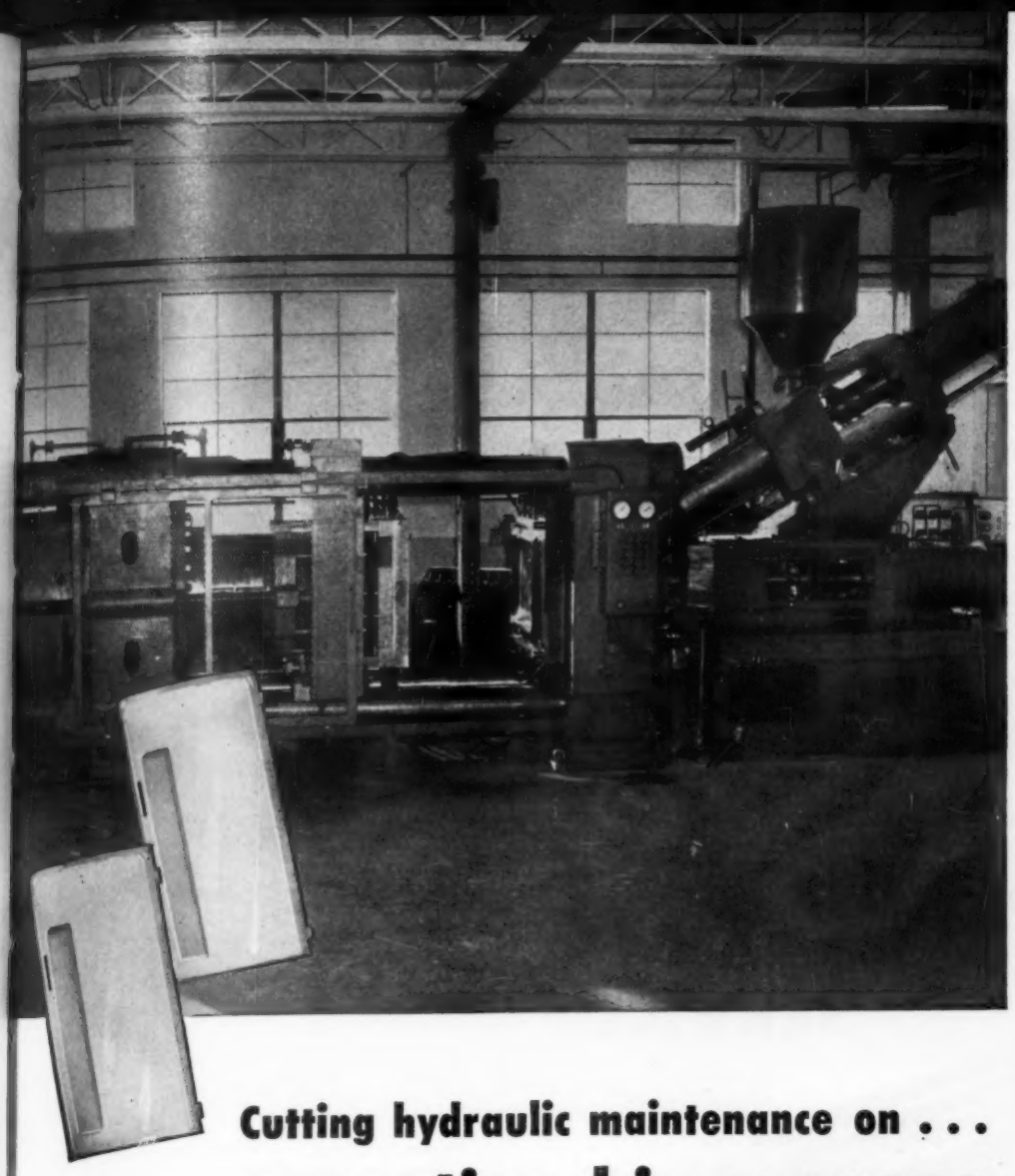

Cutting hydraulic maintenance on . . .

operation big squeeze

● Shown above is one of the world's largest injection molding machines, recently installed by the General Machine Tool and Die Company, Walled Lake, Michigan. The machine has a 1500-ton clamp, a plasticizing capacity of more than 300 pounds of material per hour, and can accommodate molds as large as 4 x 6 ft. in size.

The General Machine Tool and Die Company, pioneer of the injection molding process of plastic forming, uses the new giant injection machine to produce refrigerator door panels. Forming one entire panel per injection, this Operation "Big Squeeze" pioneers another important advance in injection molding.

In the hydraulic system of this great machine, as in ten other injection presses operated by the General Machine Tool and Die Company, STANOIL Industrial Oil has played a significant role. Withstanding severe conditions of heat and pressure, STANOIL has kept hydraulic systems clean and permitted efficient operation of units at all times. Maintenance has been kept to a minimum.

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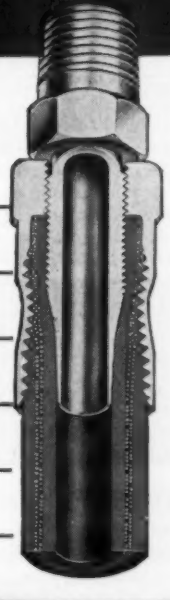

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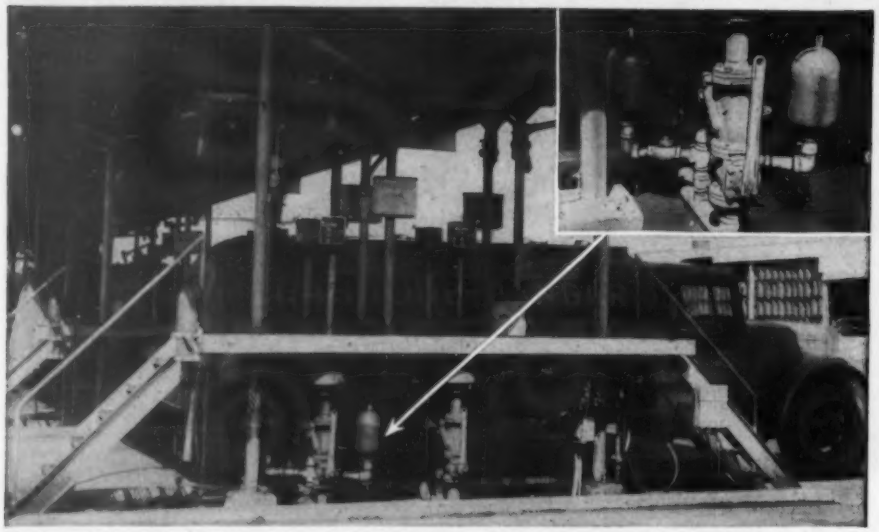
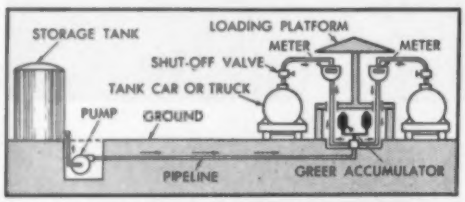
GREER TOPICS

Functions and Applications of the Greer Accumulator

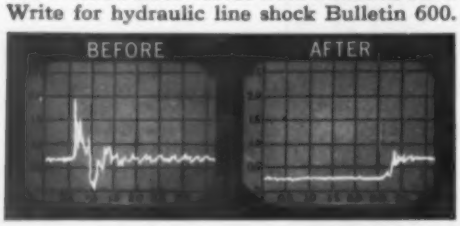


To reduce line shock effectively only two Greer Accumulators were necessary to handle this series of loading racks for petroleum bulk station. Inset: closeup of installation.

How Greer Accumulators Suppress Line Shock



Above: a schematic of bulk station operation. Below: hydrauliscope gives conclusive evidence that line shock was reduced more than 100% when three valves were closed at once. Write for hydraulic line shock Bulletin 600.



Pressure surges from rapid opening and closing of valves effectively reduced

In loading tank cars or trucks from petroleum bulk stations as an example (see schematic diagram on left), the amount of fuel pumped into a tank must be carefully measured by flowmeters.

By just opening and closing the shut-off valve, line shocks develop with great intensity to cause repetitive flowmeter failures that result in erroneous readings. This can be costly to the operator selling this fuel at a given price.

By installing Greer accumulators that function as perfect shock absorbers, these dangerous pressure surges are made harmless (see hydrauliscope test on left). The elimination of costly flowmeter and pipeline maintenance more than paid for the accumulators within a year.

If your problem is hydraulic line shock, a Greer accumulator is the answer. Let our engineers help you. Call or write today. No obligation.

Greer accumulators have many uses as:

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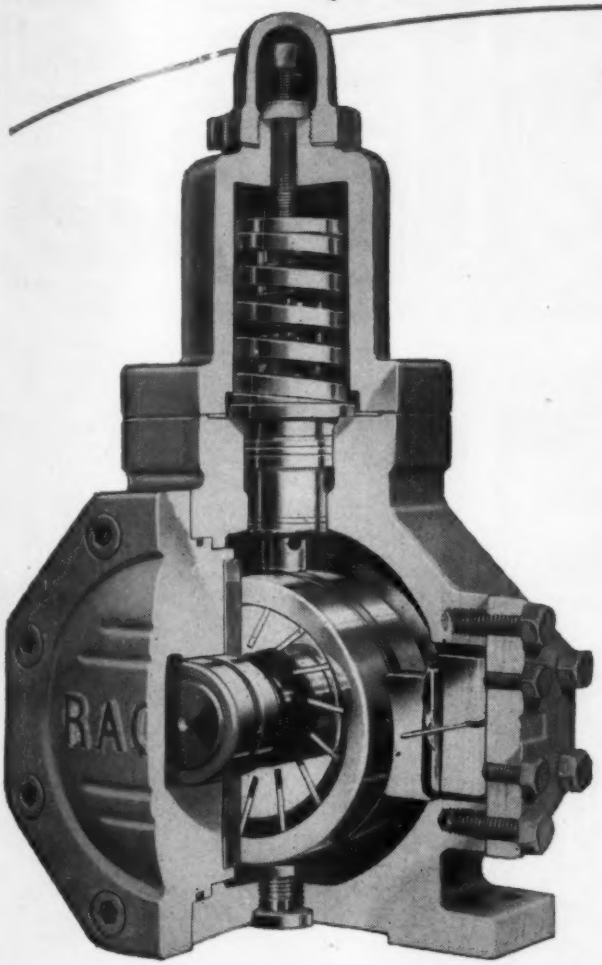
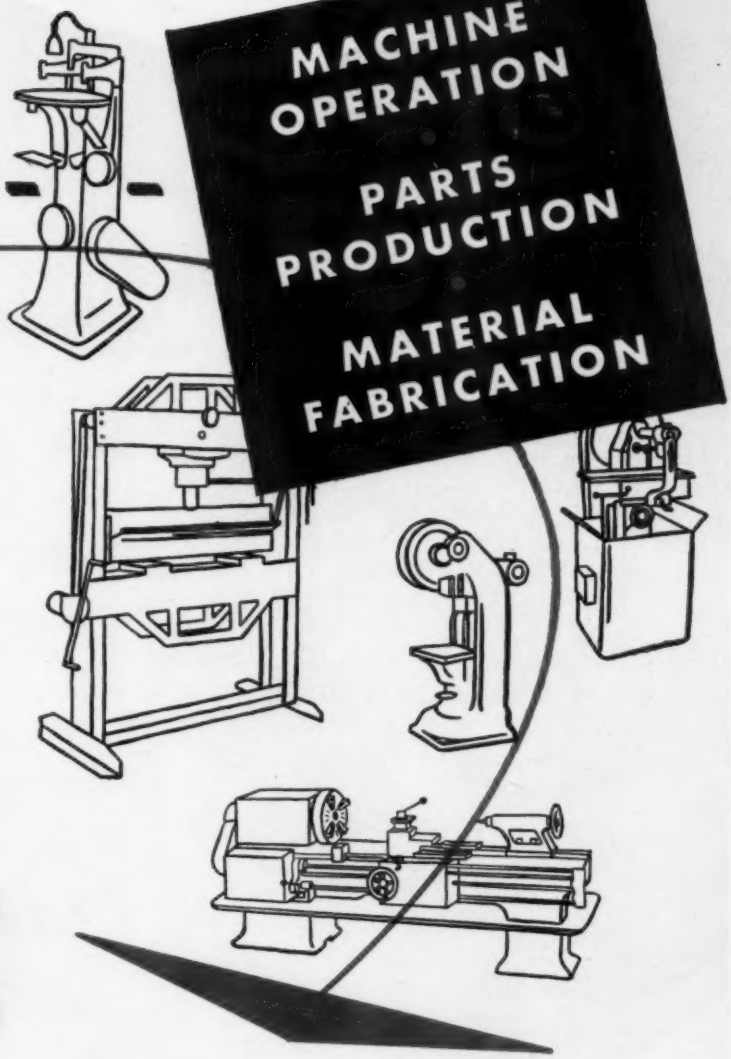
PARTS PRODUCTION

MATERIAL FABRICATION





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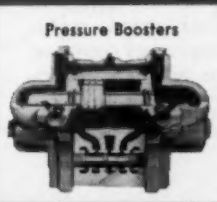

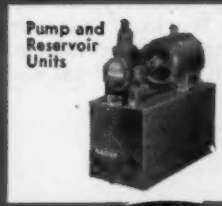

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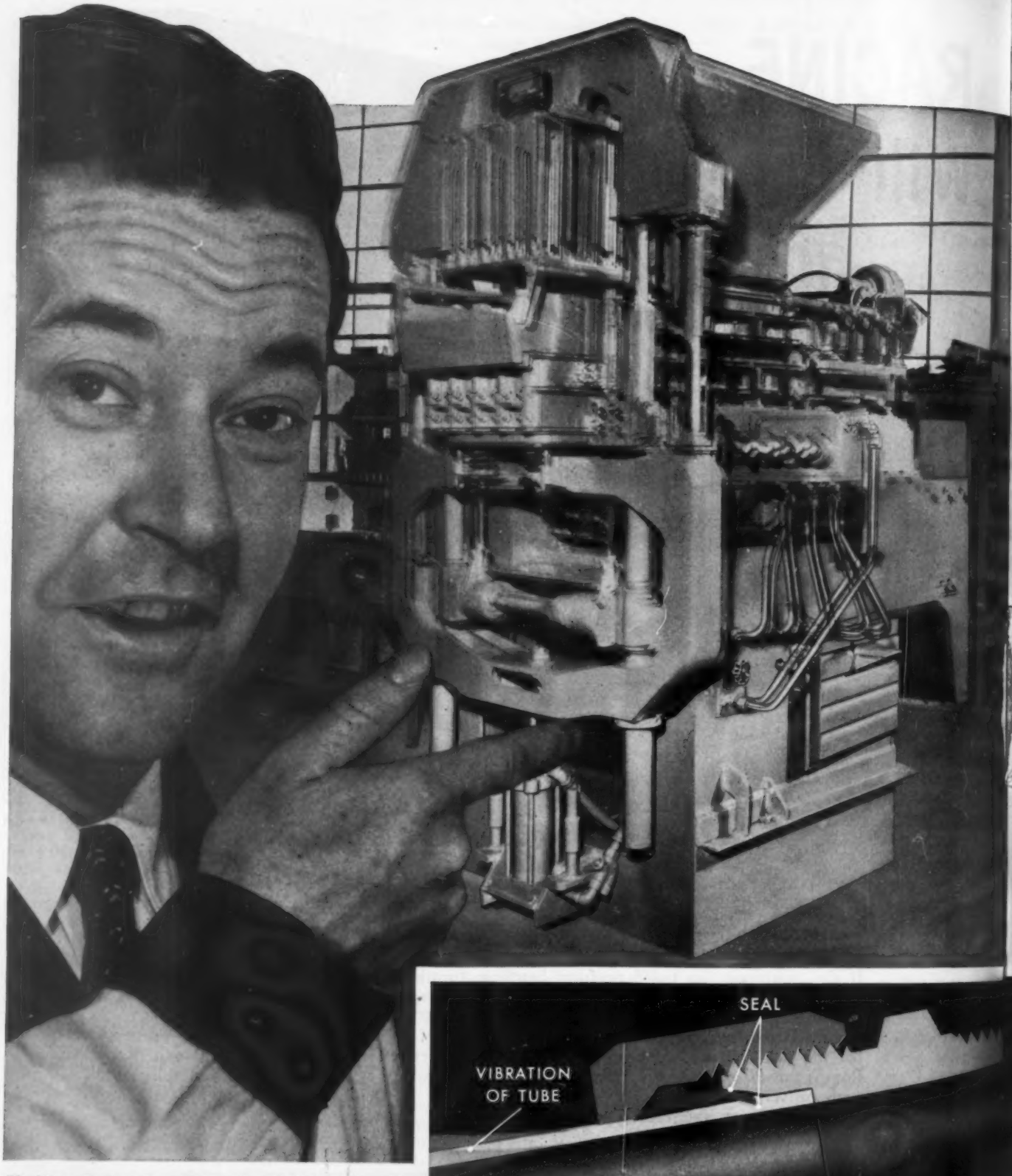
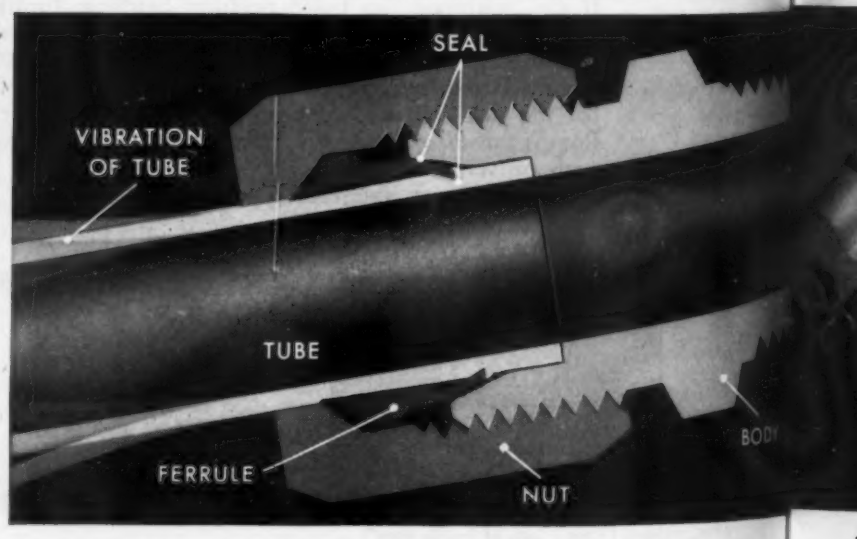


Shaking furiously, this machine, built by Columbia Machine Works of Vancouver, Washington, molds 8 building blocks per minute. It compresses concrete, vibrates it under 350 psi, and ejects finished blocks.



Cutaway shows how vibration is damped by the rear bevel of the ferrule. Note how it grips the tube. This prevents stresses at the double seal and assures a leakproof connection. The nut also helps support the tube.

GOT THE SHAKES?

Solve your tube vibration problems with leakproof Parker *Ferulok* flareless fittings

This machine shakes from stem to stern. Because of the extreme vibration, maintenance of hydraulic lines was a big problem until the design was changed to specify Parker *Ferulok* flareless fittings. Since then the manufacturer has not had a single call for hydraulic line maintenance nor received any customer complaints.

Here's what makes *Ferulok* flareless fittings leakproof on such critical applications:

These flareless steel fittings have a double seal. Wedging action of the ferrule, when drawn down by the nut, forms a seal between body and ferrule. The cutting edge of the ferrule "bites" into the outer surface of the tube, forming a second positive seal. Self-centering action assures an even "bite" around the circumference of the tube. The extent of the bite at the cutting edge of the ferrule is completely visible when the fitting is taken apart.

Vibration won't break these seals. The rear bevel of the ferrule grips the tube. This damps vibration and prevents stresses from concentrating at the line of "bite".

Parker *Ferulok* flareless fittings are designed especially for high-pressure, heavy-wall tubing. *Ferulok are the fittings that conform with the new S.A.E. Hydraulic Flareless Tube Fittings Standard.* Of course, they also meet J.I.C. Hydraulic Standards for flareless fittings.

You have no assembly problems when you specify Parker *Ferulok.* Simply use a wrench; no special tools are needed.

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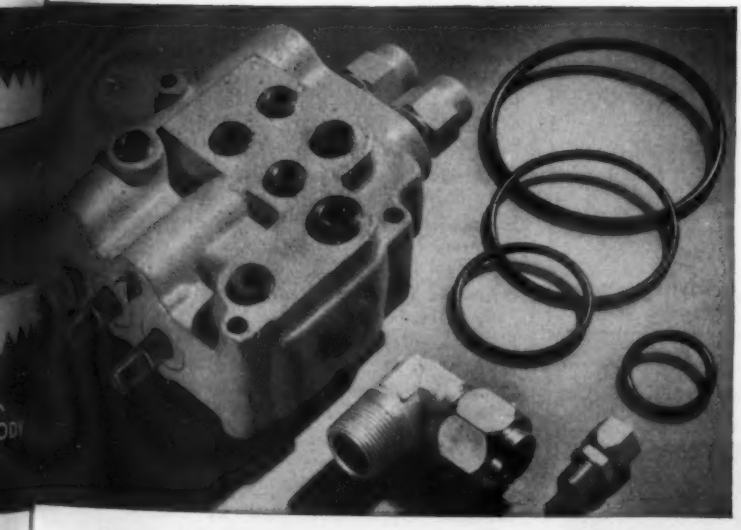

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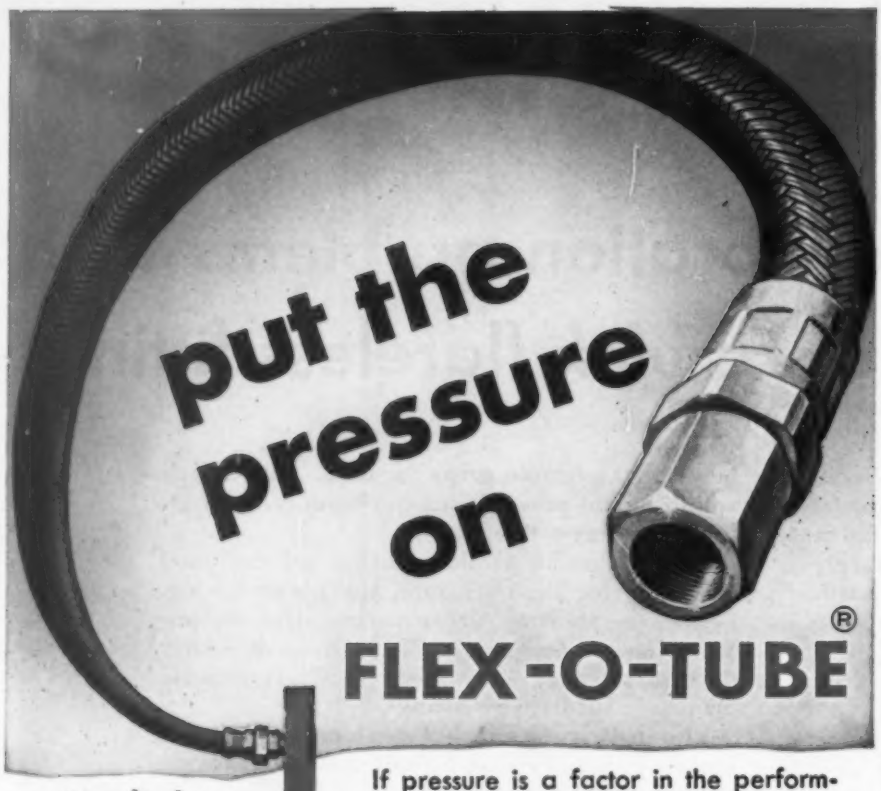

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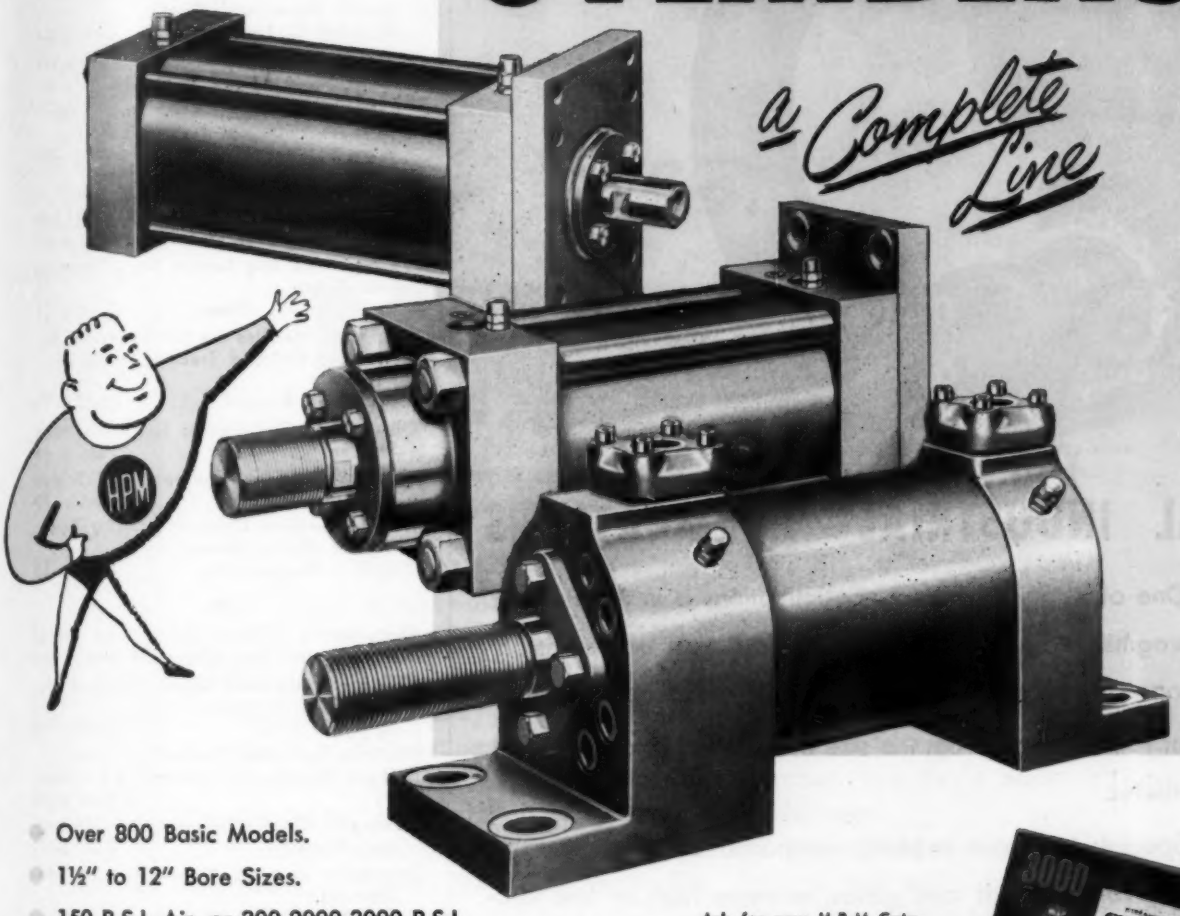

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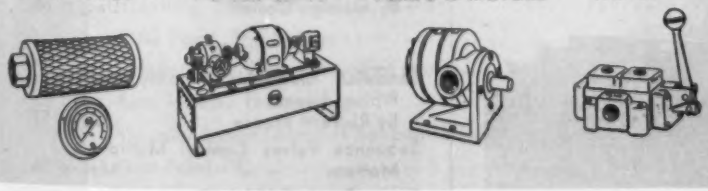

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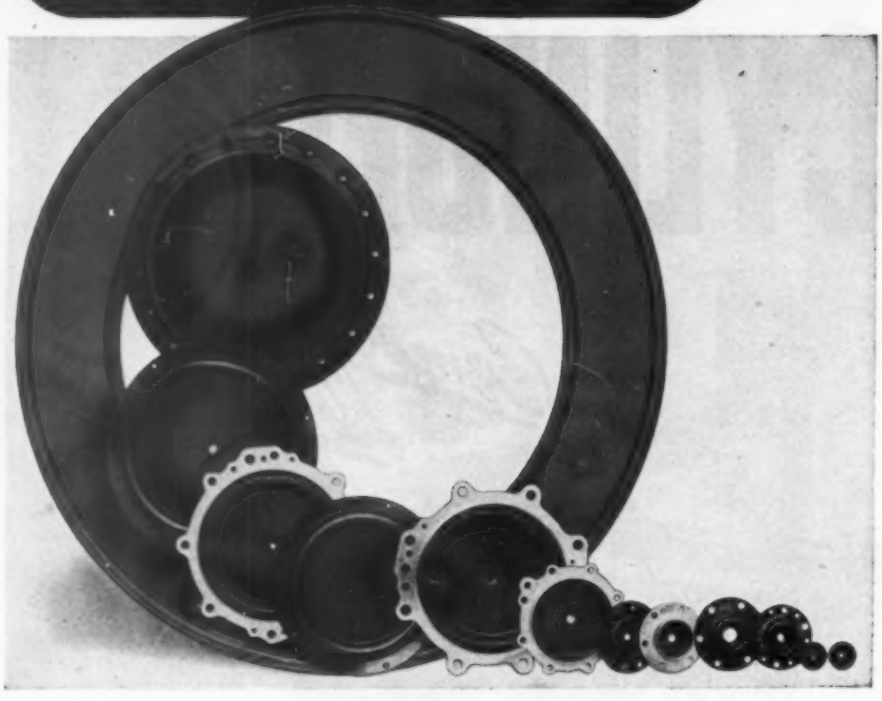

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Fire Point, °F Cleveland open cup	685
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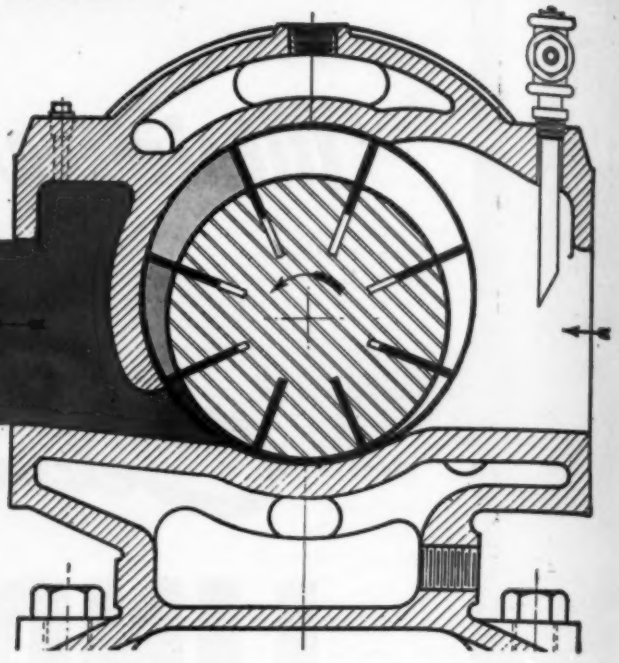

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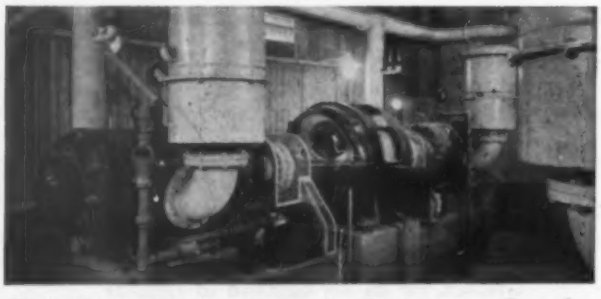

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IN HYDRAULIC POWER-
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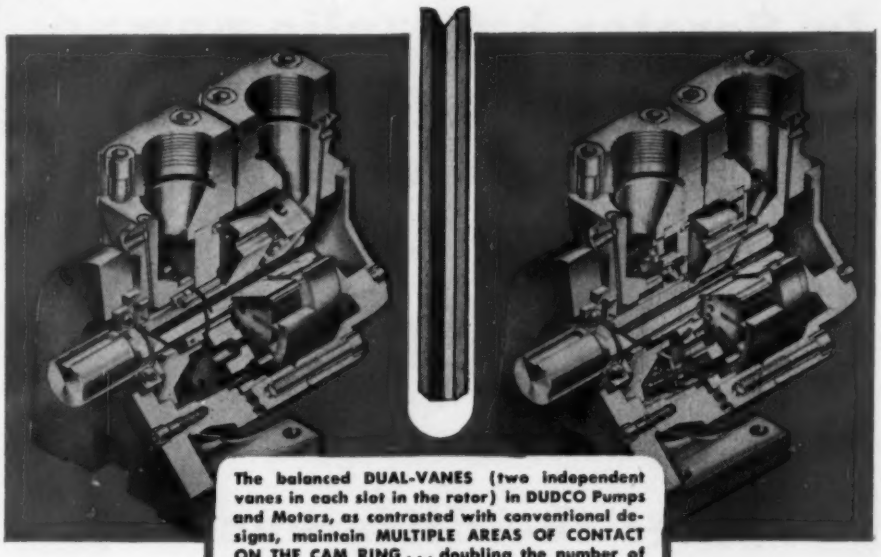

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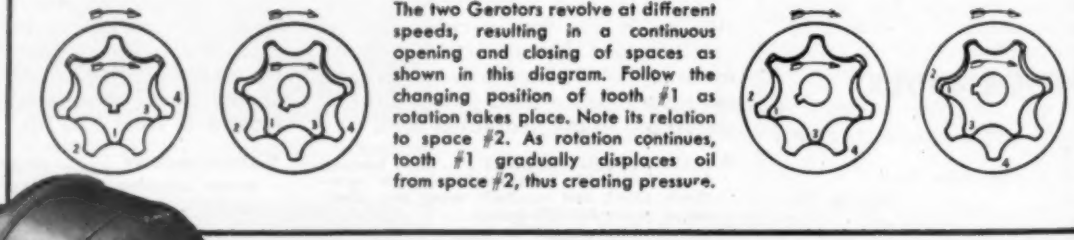

The two Gerotors revolve at different speeds, resulting in a continuous opening and closing of spaces as shown in this diagram. Follow the changing position of tooth #1 as rotation takes place. Note its relation to space #2. As rotation continues, tooth #1 gradually displaces oil from space #2, thus creating pressure.

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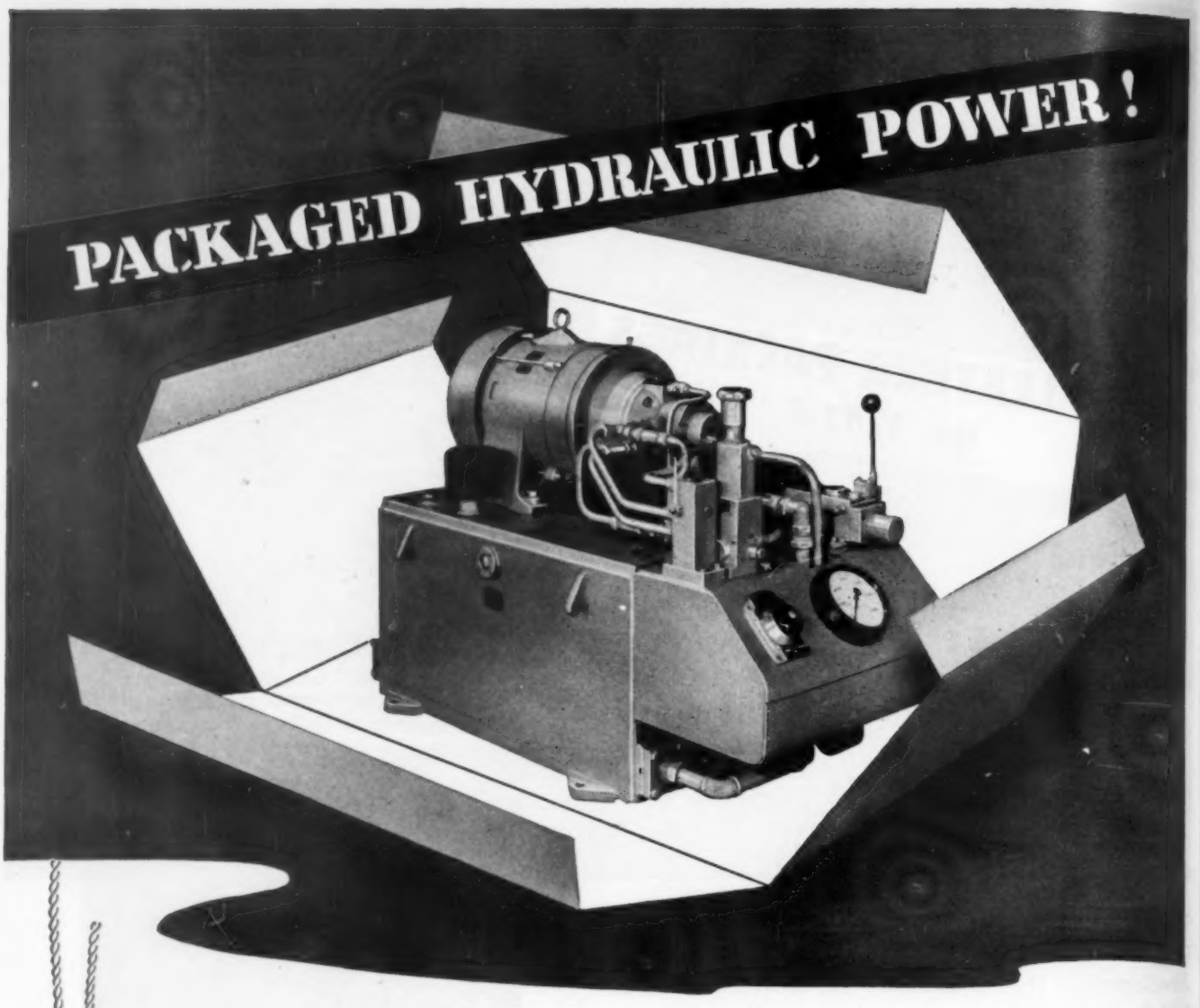

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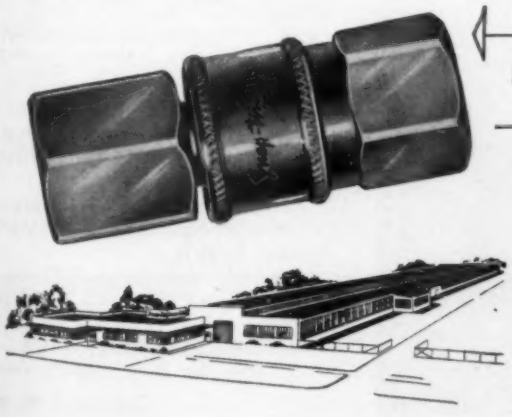

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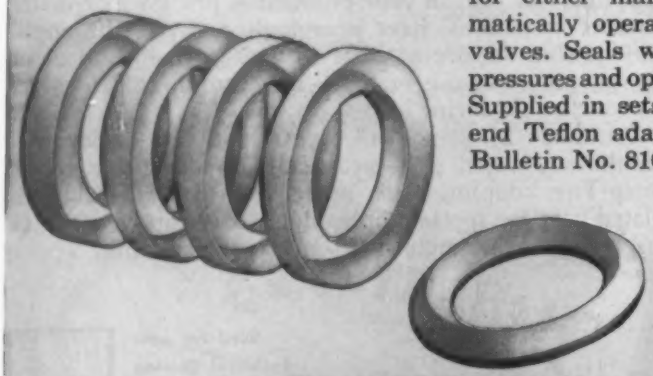

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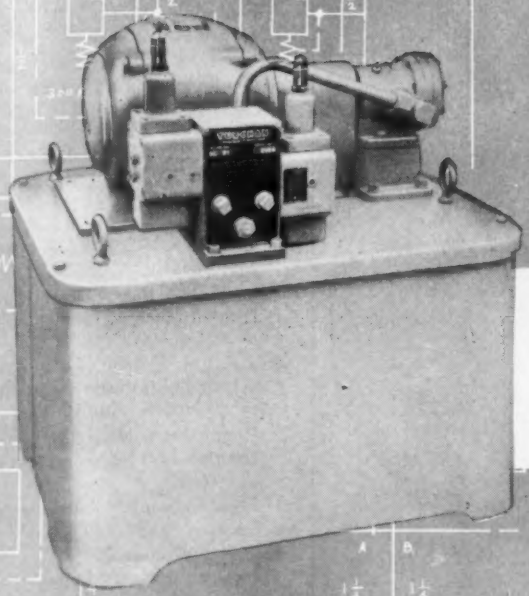

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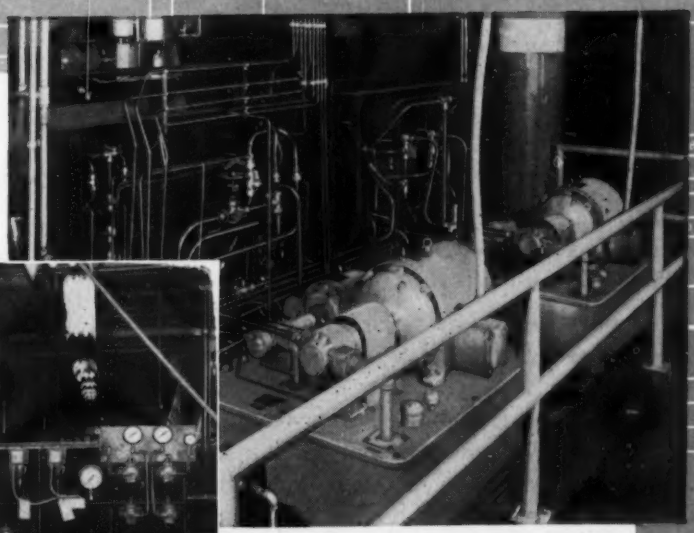

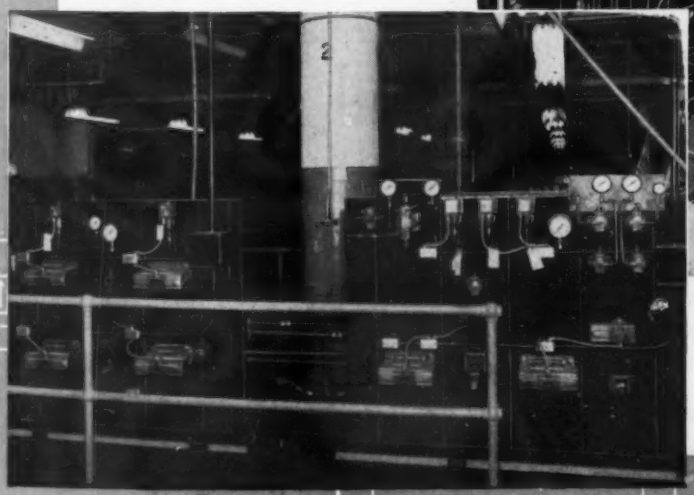

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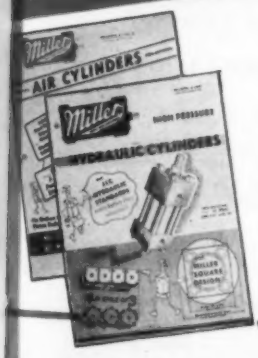

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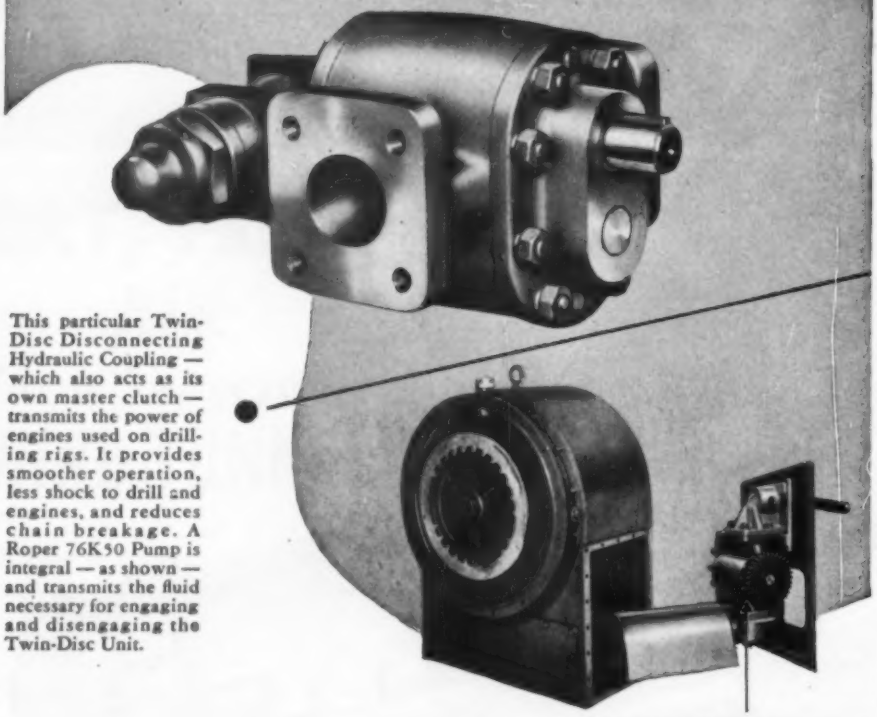

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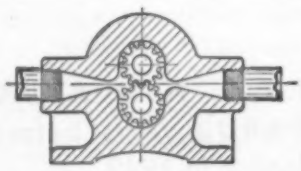

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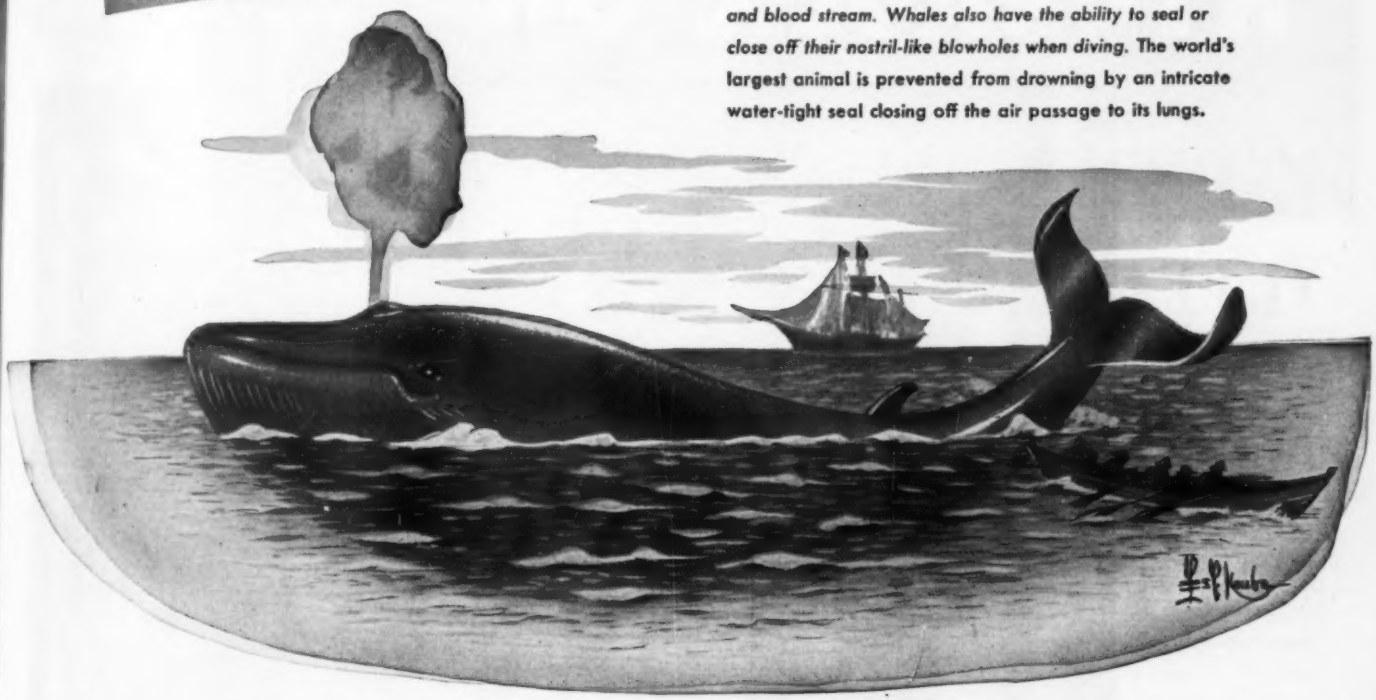
LESSONS IN HYDRAULICS

The Great Whale

Whales are the largest animals the world has ever known—larger even than dinosaurs. Blue or Sulphur-bottom whales may reach 75 or 100 ft. in length and weigh as much as 125 tons. While they look like fish and live only in the oceans, they are warm blooded, have lungs and breathe air. They are not fish but true mammals. The whale has phenomenal ability to "hold its breath" (up to an hour) while submerged. This is possible because its heartbeat and body movements slow down under water making good use of the supply of oxygen in its lungs and blood stream. Whales also have the ability to seal or close off their nostril-like blowholes when diving. The world's largest animal is prevented from drowning by an intricate water-tight seal closing off the air passage to its lungs.



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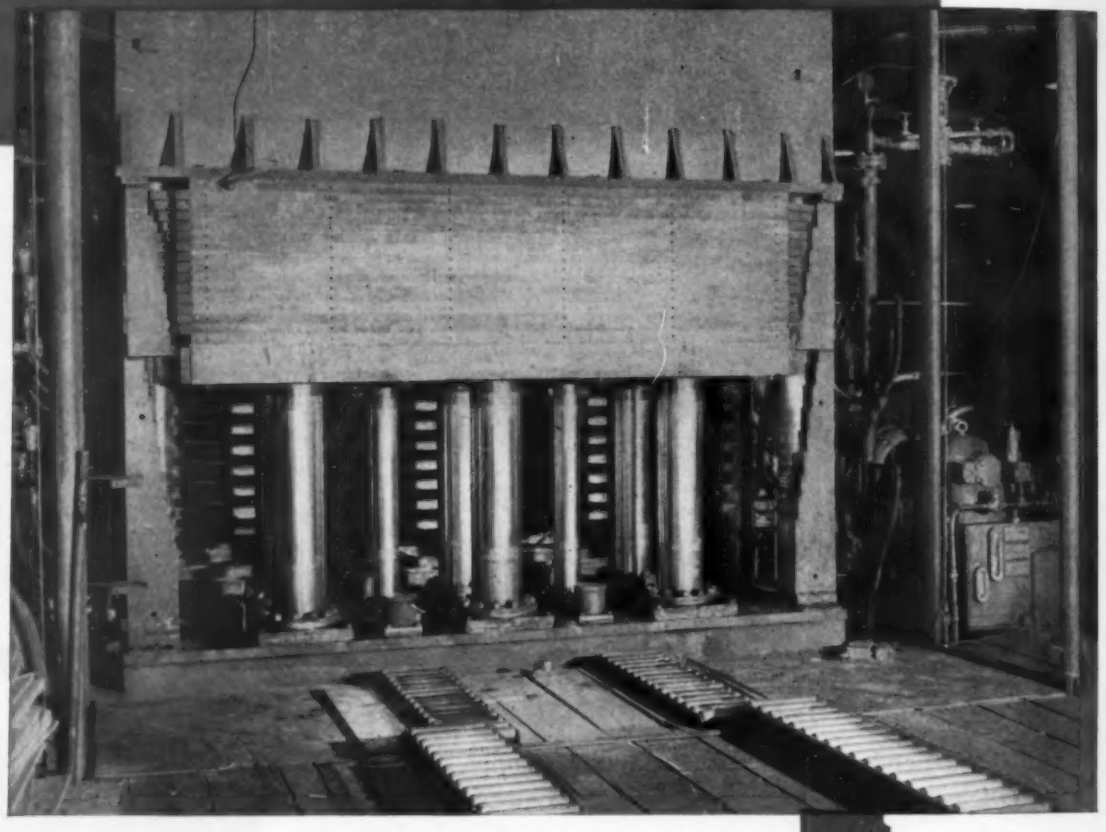

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1953

APPLIED HYDRAULICS PRIZE PAPER

Names of prize winners in the 1953 Prize Paper Contest were published in October.

By C. E. Bowman

DESIGN of a HYDRAULICALLY OPERATED biaxial fatigue testing machine

SATISFACTORY determination of the fatigue properties of a material requires that it be subjected to repeated loading through a range of stress which simulates as nearly as possible the operating conditions under which the material will ultimately be used. The surface and metallurgical condition of the test specimen should be the same or comparable to that of the prototype.

The machine described in this article was designed and built to test flat rectangular plate specimens of pressure vessel steels in fatigue, i.e., to determine the number of cycles of repeated load that are required to cause failure. From the test results it was desired to compare the cycles to failure of various grades of steel under like conditions of biaxial stress, and to compare the cycles to failure of plates of a given grade of steel which have been subjected to various surface or processing treatments. The specimens were designed to develop a ratio of 2:1 between the maximum and minimum tensile stress in the test area, which simulates the stress condition in the shell of a cylindrical pressure vessel. The hydraulic-type testing machine

FIG. 1a. Test plate is shown mounted in the fixture. Oil pressure is applied on the underside of the rectangular test plate. An "O" ring seals the test plate and backup plate.

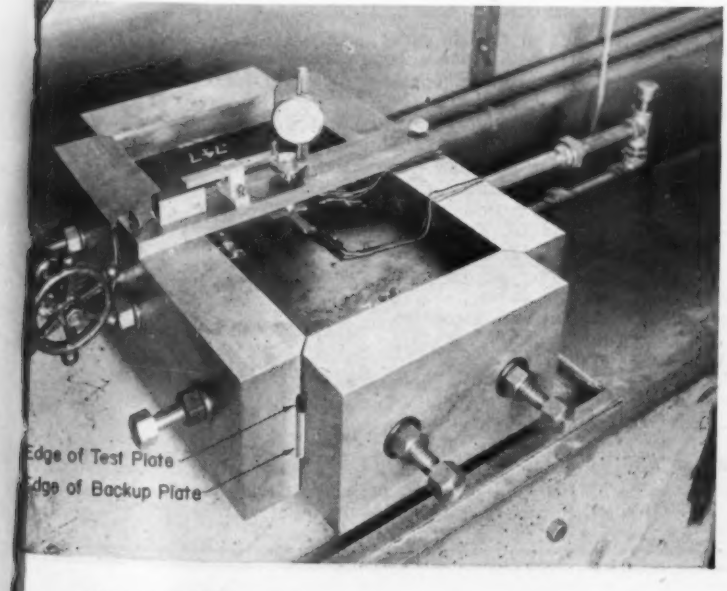
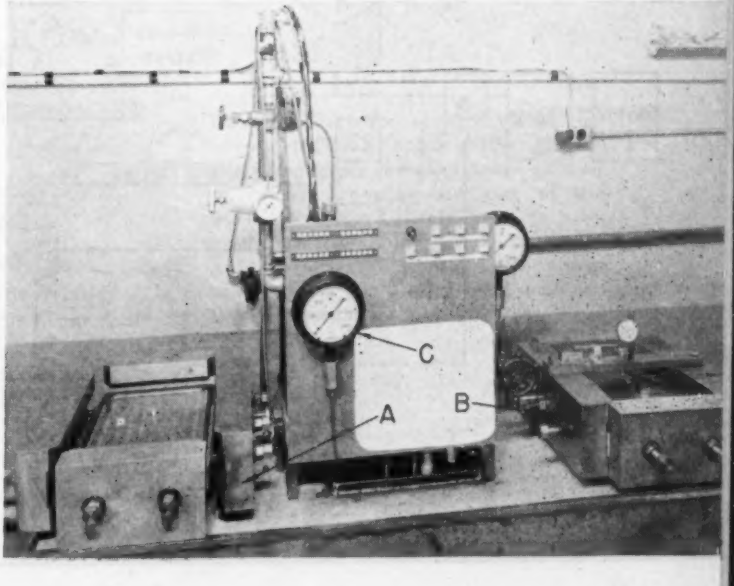


FIG. 1b. General arrangement of the pressure gauge and fixtures shows A, the left fixture with test plate removed, and B, the right fixture with the test plate mounted.



Fatigue Testing Machine

presented the only feasible method of developing the required state of stress in the plates and was readily adapted to the cyclic loading procedure.

The machine was designed to accommodate ¾ inch thick rectangular plate specimens 9-7/8 in. long x 17 in. wide which are supported freely around four edges in a fixture such that the bottom surface of the plate could be loaded with a hydraulic oil whose pressure rapidly pulsated from zero to a maximum. (See Figure 1a). As the pressure cycles were applied to the bottom surface of the plate, it deflected and thus alternately developed a state of biaxial tensile stress in the top surface.

General arrangement of the two fixtures and the pressure gage are shown in Figure 1b. The left fixture, from which the plate has been removed, shows the "O" ring that is used as a seal between the test plate and the heavy backup plate and it shows the oil port in the backup plate while the right fixture shows a plate ready for test.

Design Data

It was estimated that a minimum of one hundred plates were to be tested during the first year of operation, that the plates would have fatigue lives which would vary from a few hundred cycles of stress to several hundred thousand cycles, and that the pulsating test pressures would range from approximately 500 psi to 2500 psi.

Test specimens were to be mounted in a fixture, see Figure 1, similar to one developed at the Babcock and Wilcox Co., Research Center, Alliance, Ohio.[1]

After considering the foregoing requirements and considering the commercial components that were available, it was decided to design a machine that would have a maximum operating pressure of 2500 psi, and that would use two fixtures so that specimens could be tested in pairs thus reducing the overall test time. It was decided also that each specimen would be stressed at a rate of 100 to 200 cycles per minute, and that the machine should be operated 24 hours per day without the presence of an operator.

Hydraulic Circuit

The hydraulic circuit as indicated in Figure 2 consists of a high pressure pump which draws the fluid, oil, from a sump through a 200 mesh filter screen and discharges the oil through a check valve to an accumulator at the desired test pressure.

The accumulator in turn supplies oil to a motor driven four-way valve which alternately charges one test fixture with oil at the operating pressure and drains the other fixture to the sump. The sump is sealed to exclude foreign material but is vented to the atmosphere through an air filter. Oil in the sump is continuously circulated through a 10 micron filter and an air cooler by means of an auxiliary pump. Two valves, a spring operated pressure relief valve which is normally adjusted to open if the pressure of the oil in the system should exceed the predetermined operating pressure by more than 100 psi and a solenoid valve which drains the accumulator when the machine is shut down, are each connected into the pressure system between the accumulator and the sump. A hand operated valve is installed between the

1. The machine used at Babcock and Wilcox Co. consisted of a high pressure pump that was driven until the oil in the test fixture reached the desired pressure and was then drained through a small orifice which was open during the entire pump cycle. That design was discarded as it was inherently a slow speed machine and not suitable for the proposed test program.

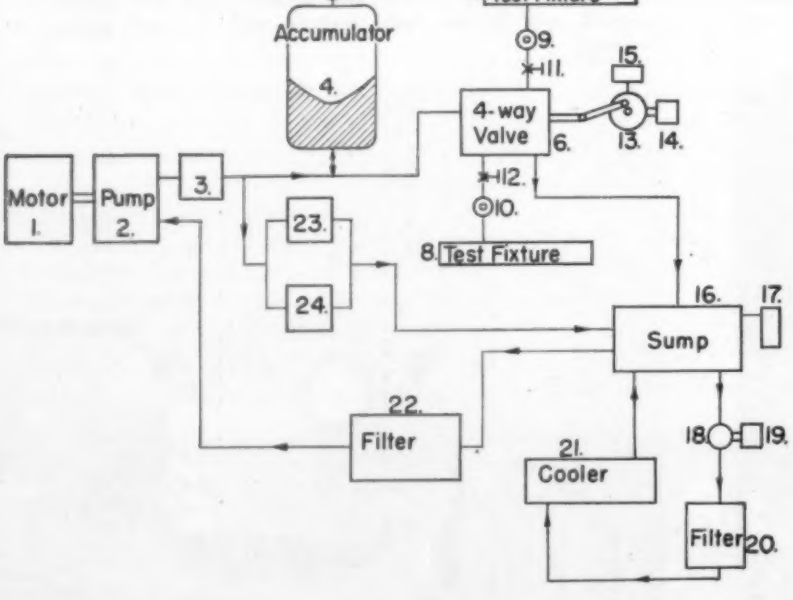


FIG. 2. Hydraulic circuit for the biaxial fatigue testing machine.

1. 15 hp electric motor
2. Hydraulic pump, compensator controlled, variable discharge, max. operating pressure 5,000 psi
3. Check valve
4. Accumulator, 5 gallon capacity, 3000 psi
5. Bourdon type pressure gage
6. Stem operated 4-way valve, 5000 psi
7. Test fixture No. 1
8. Test fixture No. 2
9 and 10. Throttling orifice
11 and 12. Globe valve
13. Motor driven crank mechanism
14. Air motor
15. Revolution counter
16. Sump
17. Air filter
18. Vane type circulating pump
19. 1/6 hp circulating pump motor
20. 10 micron filter
21. Oil cooler (air)
22. 200 mesh filter
23. Solenoid operated pressure relief valve
24. Spring operated pressure relief valve

four-way valve and each of the test fixtures so that either fixture can be disconnected from the system while the machine is in operation. A throttling orifice is installed between the four-way valve and each of the fixtures to eliminate pressure surges during operation.

The four-way valve is driven by a variable speed air motor which permits control of the valve operation from zero to 105 cycles per minute. That variable speed feature was extremely valuable during the initial phase of the research program although all later tests were conducted at approximately 100 cycles per minute. A revolution counter is mounted on the air motor and is used to count the number of pressure cycles applied to the plate specimens.

Control Circuit

The electrical control circuit, see Figure 3, was designed to incorporate all possible safety precautions for the protection of the operator and the equipment and it also affords maximum ease of operation.

The control system consists of a 110 volt A.C. power supply circuit connected through an auxiliary four-pole relay to a series circuit which includes the relay solenoid and four micro switches. The circuit consists of the relay solenoid (which when energized held the four-pole switch closed), the air line micro switch, the sump micro switch, pressure relief valve micro switch, and the test plate micro switches. Each of the above micro switches are normally closed, but if any one of them opens, the control circuit is broken and the relay is de-energized thus opening the four-pole switch. Several different conditions can cause a micro switch to open; namely, failure of the air supply to the motor that drives the four-way valve, loss of oil in the sump, excess pressure causing the spring loaded relief valve to operate, and excessive deflection of either one of the plates.

Opening of the four-pole switch in turn causes changes in a number of important operations, for example: it breaks a circuit which is connected in series with the push button station that controls the drive motor for the high pressure pump, thus shutting off the pump; it stops the motor driven pump that circulates oil through the 10 micron filter and the oil cooler; it stops the motor that drives the four-way valve by deactivating a solenoid valve thus shutting off the air supply; it deenergizes a second solenoid valve and thus permits the high pressure fluid that is stored in the accumulator to drain to the sump.

Closing the spring-return two-pole starting switch, puts the system in operation. When the control circuit is continuous, the relay closes the four-pole switch and starts the air motor, the filter pump, and completes the circuit through the push button control station for the main pump. The main pump is then started by manually pushing the start button.

Operating Characteristics

Upon completion of the machine, it was necessary to determine the pressure-time relationship in each fixture; that is, to determine whether there was sufficient time for the hydraulic fluid in the fixtures to build up to the test pressure as the four-way valve cycled at its maximum rate and if there was sufficient time for the fluid pressure to drop to zero during the discharge portion of the cycle. To determine the pressure-time relationship, oscillograph records, see Figure 4, were made as the machine operated near its maximum speed. One oscillograph trace recorded the variation in pressure with time at a point where the hydraulic fluid entered one test fixture, and the second and third oscillograph trace recorded the variation of the maximum strain with time at the center of each plate, the time being indicated by the straight lines across the oscillograms.

Records thus obtained indicated that the pressure-time characteristics were satisfactory except that there was a pressure surge and subsequent oscillation of the specimen (see Figure 4) as the four-way valve opened which allowed the maximum pressure in the

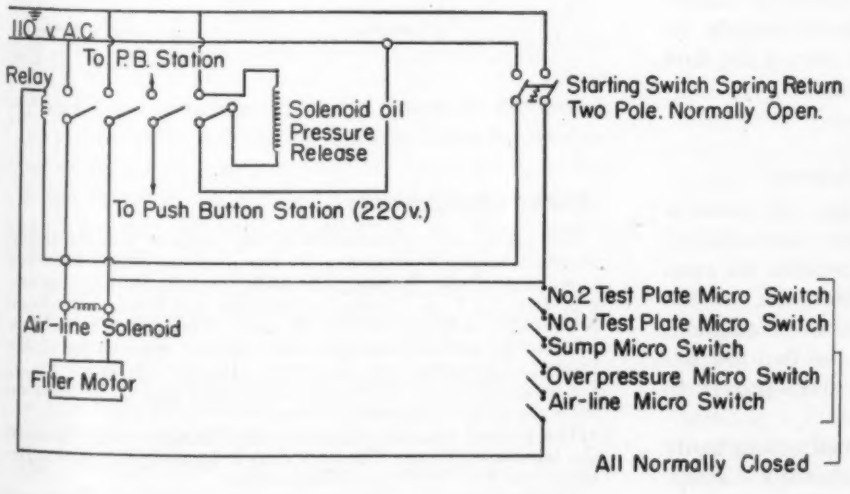


FIG. 3. Electrical control circuit incorporates all possible safety precautions and gives the maximum ease of operation. Opening any one of the normally closed limit switches de-energizes the relay to open the 4 pole switch, which stops the pump motors and air motor and unloads the accumulator.

fixture to exceed the average pressure by 8 per cent. A 1/8-inch thick disk with 3/16-inch hole drilled in its center was placed in the high pressure oil supply line to one fixture and it was found that this orifice practically eliminated the surge, see Figure 5-B. A similar orifice was placed in the supply line to the second fixture, and later oscillograph records indicated pressure-time cycles of the type in Figure 5-B for a wide variety of conditions of operation.

Operating pressure is controlled by means of the pressure compensator on the pump. It was found that after careful adjustment the pressure would not vary more than one or two per cent over an operating period of 24 hours.

System Components

The main pump is a variable-volume axial-piston type having a maximum capacity of 10.8 gal. per minute, and is driven by a 15 H.P., 1800 RPM, 220 V, 3 phase motor. The pressure compensator control which is an integral part of the pump automatically regulates the discharge by changing the length of stroke of the pump pistons. When the pump is operating at a pressure less than the compensator setting, it delivers full volume but when the pressure compensator setting is reached, the volume is automatically reduced to the quantity of flow required to maintain that pressure. The pump is capable of developing a maximum pressure of 5000 psi.

The accumulator which has a capacity of 5 gallons and a pressure rating of 3000 psi contains a neoprene bag to separate the gas (nitrogen) from the oil. The four-way valve is a spool type valve that is stem operated, the stem being driven by an air motor, the type normally used as an air drill.

The design permits the main pump to operate at approximately constant discharge while the nitrogen gas in the accumulator adjusts for the cyclic volume demand of the four-way valve.

The biaxial fatigue testing machine was used to test over 100 specimens whose fatigue lives ranged from 3000 cycles to over 1 million cycles at pressures which ranged from 475 psi to 1750 psi. Approximately 15 million operating cycles were applied during the first year of operation.

Conclusions

The following conclusions may be drawn:

1. Development of this special equipment made it possible to develop a unique pressure-time relationship necessary to conduct important studies on pressure vessel steels. Operating characteristics of the machine such as cycling speed, pressure regulation, and the pressure-time relationship in the two test fixtures during each cycle of operation have proven to be entirely satisfactory.

2. The hydraulic circuit has performed satisfactorily and has required little maintenance through 15 million cycles of operation.

3. The electrical control circuit has performed satisfactorily insuring safety of operation and has required no maintenance.

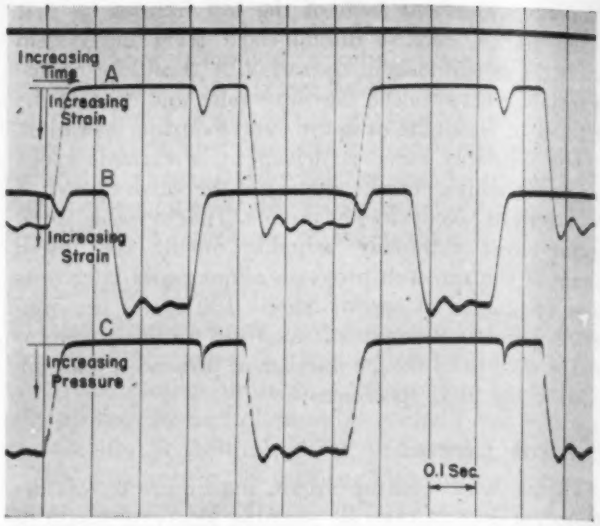
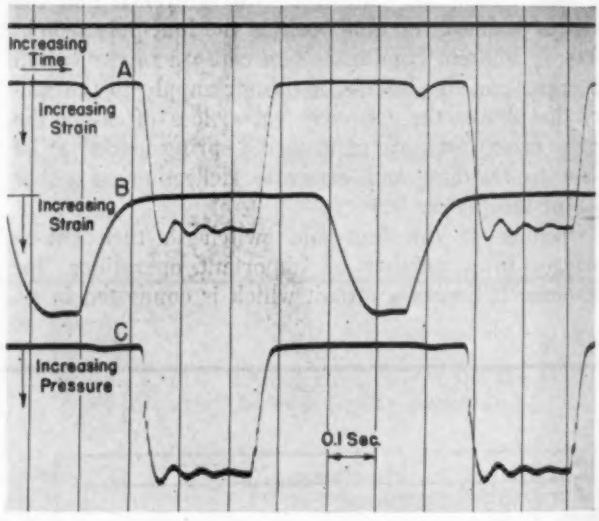


FIG. 4. On this oscillogram, A shows the strain on the top surface of the left test plate during a time interval of approximately 1 second and during two pressure cycles. B shows the strain on the right test plate, and C plots oil pressure in the right test fixture.

FIG. 5. To remove the pressure surge and subsquent oscillation of the specimen as the four-way valve opened, an orifice was placed in the high pressure oil supply line to the right fixture. Curves C and B show the removal of the surge as compared to Figure 4. An orifice later placed in the line to the left fixture removed the surge in curve A.

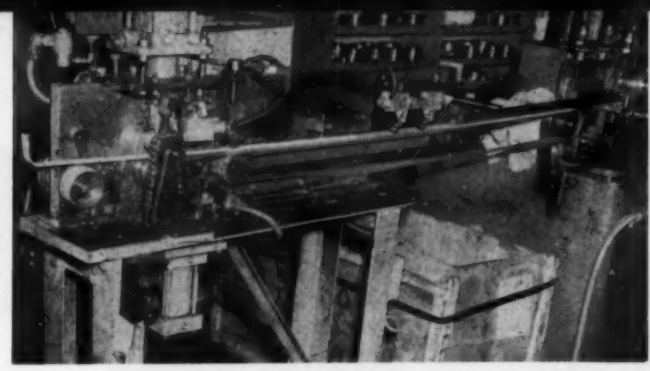


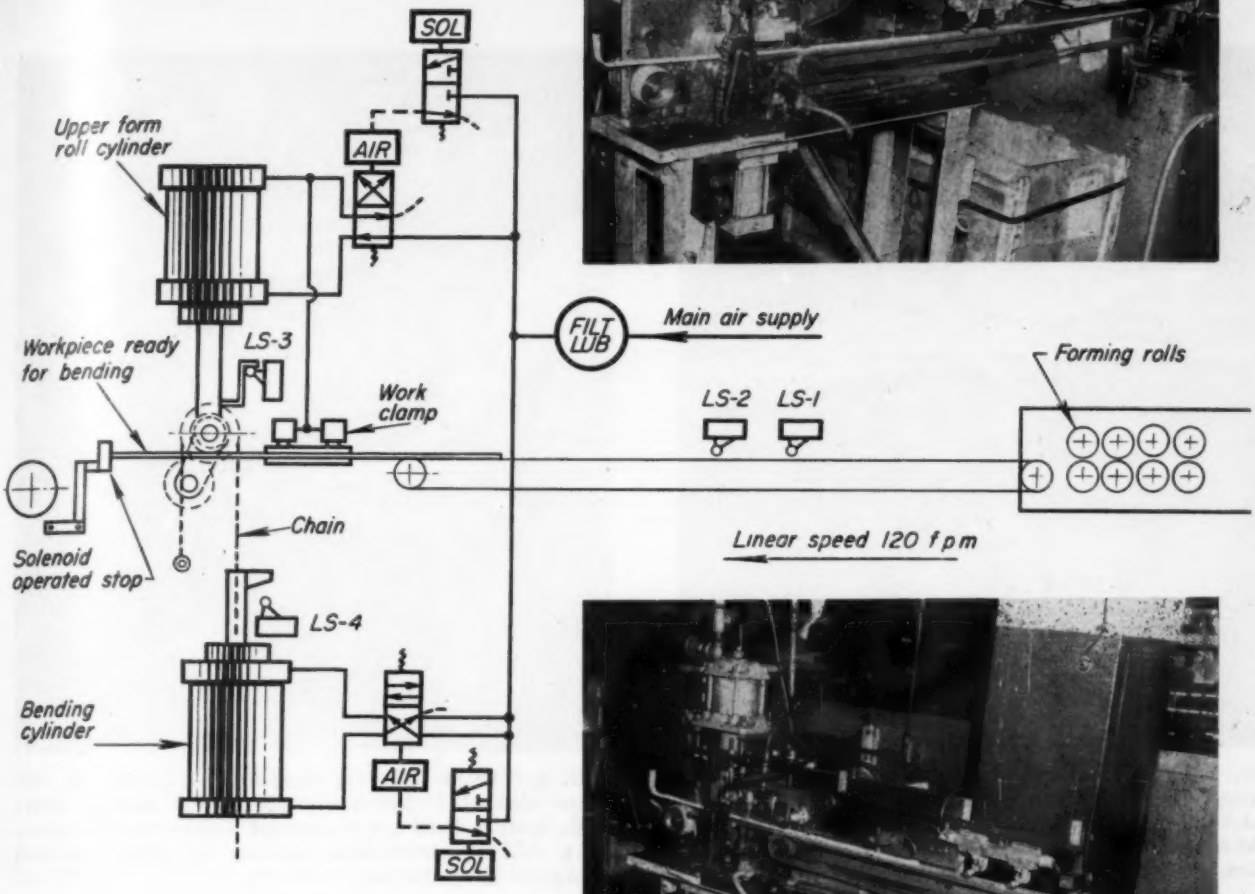
Acknowledgments

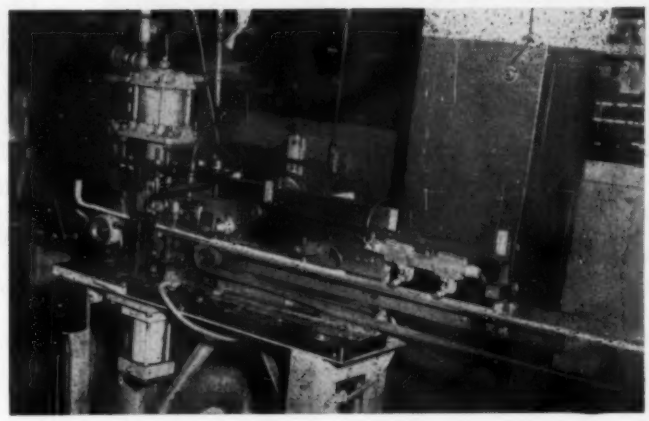
The design and construction of this machine was the initial phase of a project sponsored by the Pressure Vessel Research Committee of the Welding Research Council, William Spraragen, director. P. R. Cassidy is chairman and Boniface E. Rossi is executive secretary of the Pressure Vessel Research Committee. The project was under the general supervision of the Project Committee on Increased Design Stresses, L. F. Kooistra, chairman. Professors T. J. Dolan and C. E. Bowman were the project engineers.

The project was carried out at the University of Illinois in the laboratory of the Theoretical and Applied Mechanics Department. Professor T. J. Dolan, Head.

The basic design of the machine was conceived by Professor T. J. Dolan and he and Mr. H. T. Musgrove made many important suggestions during its construction.







Rotary Bending with an Air Cylinder

By George Coslett

TRANSLATING linear motion of an air cylinder to a rotary motion of the forming tool is accomplished on a curtain rod bending fixture by connecting the piston rod to a chain and sprocket mechanism. Layout of the air powered forming machine, which is used in the shops of the George H. Hees Son & Company, Ltd., Toronto, Ontario, is shown in the drawing and photographs.

Russell Cowan, superintendent at Hees has made this machine automatic by using limit switch actuation of the air circuit. Flat brass metal strips; cut to proper length, are fed into a rolling machine which is in line with the forming fixture. Forming rolls create the cross-sectional form of the curtain rod. Feeding out from the form rolls onto a continuously moving belt, the strip is carried into the forming fixture at a speed of 120 fpm.

As the curtain rod moves into the fixture, LS-1 is tripped to energize the direct solenoid operated stop. One end of the work piece hits the stop while the other end passes under LS-2. LS-2 energizes the solenoid controlled pilot operated air valving in the clamp circuit to move the upper form roll down on the work and to move the single acting clamp cylinders.

LS-3 is tripped when the upper form roll moves down. The valving on the lower bending cylinder is then energized to apply air to the rod end of the bending cylinder. As the cylinder retracts it pulls a chain which turns a sprocket and crank mechanism. The bending roll swings upward to complete the forming operation. Completion of the bending cylinder stroke trips LS-4 to deenergize all solenoids and return the cylinders. The solenoid operated stop drops, permitting the curtain rod to move through the machine.

GEORGE COSLETT, John Spotton Company Ltd., Toronto, Ontario.

FIG. 1. THIS VETERAN mechanical bulldozer, equipped with an air cylinder to operate the clutch and brake, is more efficient and safer than the original equipment. The foot operated valve frees both operator's hands for loading and unloading parts.

FIG. 2. THE USE of a pendulum mounted air cylinder converted this heavy duty three station rotary table from a hard job to a much easier one. Actuation of a foot operated valve releases an index pin and energizes the cylinder.

4 Ways to Use Air to In

USE of air power in the Machinery Division of Minneapolis-Moline Company at Hopkins, Minn., has transformed a number of operations that formerly involved very exhausting labor into simpler, easier and faster operations. In other cases, air has increased the utility of individual machines and pieces of equipment. The overall use of air in this plant has been progressive as each succeeding application proved itself. Operations converted to air power have not only increased production and therefore cut unit manufacturing costs but has considerably reduced operator fatigue with a resulting lower labor turnover.

The predominance of heavy machines, heavy tools and heavy work pieces involved in the manufacture of agricultural equipment used to mean that most operations entailed wearying labor. Many operations are performed on piercing, stamping and forging presses, brakes and bulldozers. Loading and unloading and handling operations were the bottletnecks. A study made by Art Slathar of the Tool Design Department under the supervision of Nick Even, plant superintendent, resulted in recommendations to convert several of the heavier manual operations to air. As each installation proved itself, additional installations were made.

A visit to the plant disclosed that a wide range and variety of operations were being performed by air power. Air was selected because it was available in the shop and because most of the installations were relatively simple and easy to maintain. Four applications, which will be briefly described, are typical of the air power usages in this plant.

Air For Clutch Operation

The bulldozer, shown in Figure 1, the clutch and brake of which is air cylinder operated, was originally furnished with a handle for engaging the clutch. The handle extended along the main axis of the machine and was bent so that the end was just above the crosshead. The operator had to bend over the center of the

FIG. 3. AN AIR cylinder replaced a hand operated chain block to drop a monorail section of a trolley conveyor. Here grain drill parts are being lowered into a paint dip tank. A stirrup control operates the valve, making the dipping operation easier and faster.

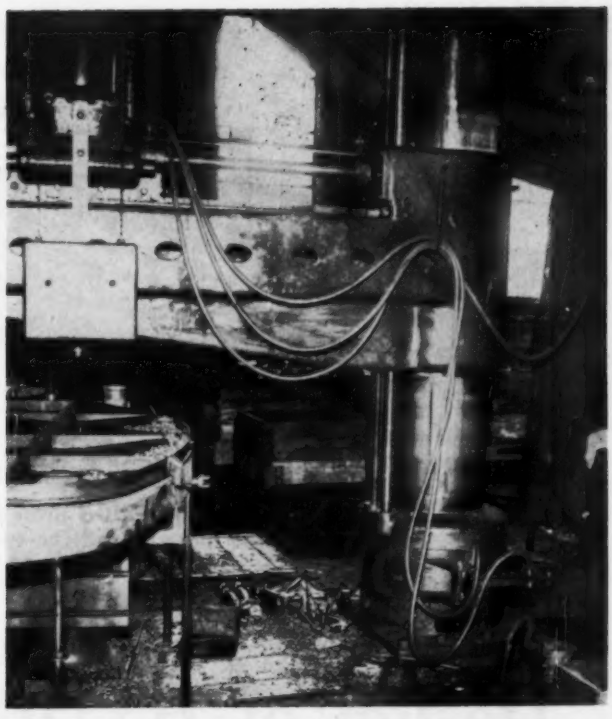


FIG. 4. AN AIR cylinder which replaced a hand operated lever to lock the column of this eight foot radial drill made it possible to add several machine hours per day to the shop's drill capacity. The air device raised the drill's output closer to that of lighter drills.

to Increase Machine Output

machine, disregard the movement of the loaded ram and give a good yank on the handle. With the air cylinder mounted on the machine housing adjacent to the clutch operating yoke, the clutch is engaged by the action of the operator depressing the foot valve. This arrangement allows him to use both hands to load and unload parts into the die without stopping the travelling ram. In addition, the air circuit represents a safety feature because the moment the valve is released, the machine stops. This installation is typical of a number throughout the shop where mechanical clutches were originally furnished.

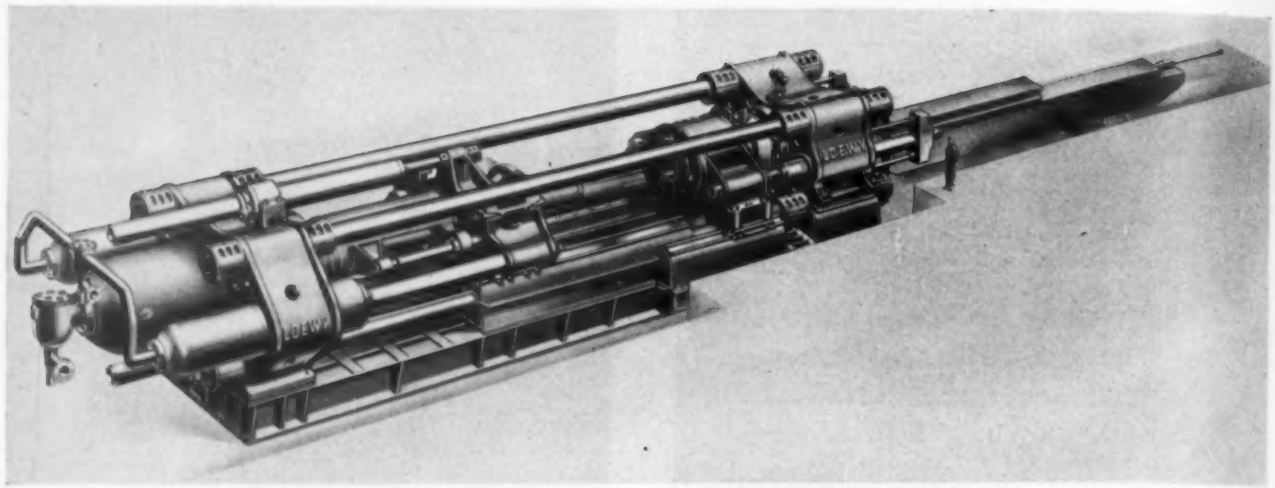
Another example of a hard job made easy in this plant is the operation of a heavy three station rotary table on a Barnes Hydram (Figure 2). A pendulum mounted cylinder indexes the table. The operator steps on a foot valve lever which releases the index pin and energizes the cylinder. A bumper on the piston rod pushes against blocks mounted on the OD of the table. Exhaust silencers, one of which is installed with this cylinder, are in general use through the plant to eliminate air exhaust noise.

Cylinder Used on Paint Dip

Extensive use is made of overhead monorail trolley conveyors. At two stations of the conveyor system paint dip tanks are located so that single or nested groups of parts could be painted by a quick dunking operation. The method used previously was to stop the conveyor and lower the part or parts on one station by a hand operated chain block. After a short immersion, the load was partially lifted, free of the tank, for the excess paint to drip. Then the load was lifted by the chain block up to its original position on the conveyor and the conveyor started up again.

Figure 3 shows one of the paint dip stations. An air cylinder operates the conveyor load unit much easier and faster. The illustration shows the load unit of a

Continued on page 86



THIS 12000 TON EXTRUSION press being built as part of the United States Air Force heavy press program will be operated by Curtiss-Wright in Buffalo, N. Y.

Design of HYDRAULIC SYSTEMS for Heavy Presses

Part 3 Control Circuits

By Arthur Greensite

BEFORE discussing hydraulic circuits, it might be well to say a word about the symbols used in the diagrams. Because of the many unique features of construction and operation in heavy press valves, it was found desirable to retain the system of identification normally used in this field, rather than the JIC symbols. The symbols used, being schematic representations of the valves, are more or less self explanatory. The open and closed positions of the valves are represented respectively by the up or down position of the triangular elements each of the latter representing a valve. As shown in the hydraulic diagrams, several of these valves (i.e. triangular symbols) are incorporated in one forged steel valve block. The operation of each valve will be described in detail when discussing its function in the hydraulic circuit.

Figure 1 is a simplified control diagram of the Loewy 12,000 ton extrusion press. The main crosshead holds the extrusion stem (not shown). The force from the main and side cylinder acts on the main crosshead and is thereby transmitted to the extrusion stem. The main return cylinders, as the name implies, act to return the main crosshead to the retracted position. The mandrel cylinder is housed in the main ram, so that, by advancing the extrusion stem, the mandrel is simultaneously advanced. However, at a given point in the cycle, the mandrel is capable of being advanced independently of the extrusion stem. Separate return cylinders are provided for the mandrel.

A normal operating cycle is as follows:

1. Main and side cylinders are advanced under prefill pressure (approx. 100 psi)
2. High pressure is introduced to main and side cylinders
3. Pressure is then introduced into mandrel cylinder advancing the mandrel independent of stem
4. Entire unit is retracted by introducing pressure into the return cylinders.

In Figure 1, the press is shown in the retracted

ARTHUR GREENSITE, Design Engineer, Loewy Construction Co., Inc., New York, N. Y.

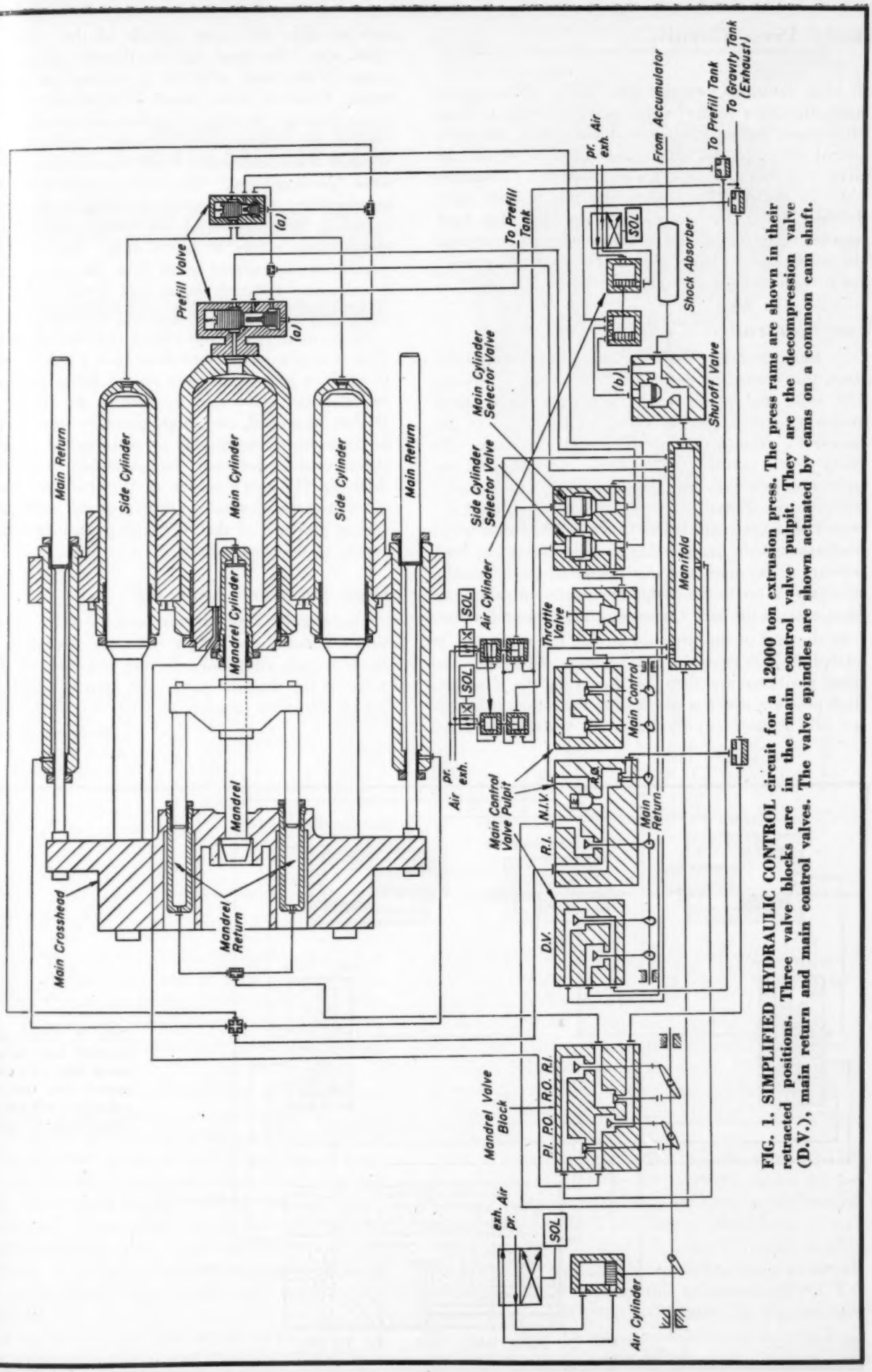


FIG. 1. SIMPLIFIED HYDRAULIC CONTROL circuit for a 12000 ton extrusion press. The press rams are shown in their retracted positions. Three valve blocks are in the main control valve pulpit. They are the decompression valve (D.V.), main return and main control valves. The valve spindles are shown actuated by cams on a common cam shaft.

position. Consider now the three valve blocks constituting the main control valve pulpit. They are, from left to right, the decompression, main return, and main control valve blocks. The valve spindles of all the valves are actuated by cams mounted on a common shaft. In the position shown, the return inlet valve (labeled R.I. in the diagram) is open, so that high pressure water is admitted to the main return cylinders. The return outlet valve (labeled R.O. in the diagram), which opens to gravity tank or exhaust, is closed.

Cam Controlled Cycling

To start the cycle, the cam shaft is rotated 90 degrees, this closes the decompression valves, opens the R.O. valve and closes R.I.; the main control valves remaining closed. As the main return cylinders are opened to exhaust, the prefill water overcomes the spring force in the prefill valves and advances the main and side cylinders during idling stroke under low pressure. Rotating the cam shaft another 45 degrees opens the main control valves (the other valve positions remain unaltered), thereby admitting high pressure to the main and side cylinders, the admission of high pressure to the prefill valve automatically seats the spindle of the prefill valve shutting off prefill water.

At the end of the pressure stroke, the cam shaft is rotated 135 degrees in the opposite direction. The valve positions are then as shown in the diagram. High pressure water is admitted to the return cylinders and also to port (a) of the prefill valves. The latter acts to make the lower spindle of the prefill valve "kick open" the upper spindle, thereby permitting the water in the main cylinders to exhaust to the prefill tanks. However, since there is a locked column of water between the main cylinders and the closed main control valves, the "lower spindle" would be unable to open the prefill valve unless this column of water were "decompressed." This is accomplished by the decompression valves. The line from the prefill valves is bypassed through the selector valves and to the decompression valves to prefill tank. Then the major portion of the exhaust water from the main cylinders is exhausted through the opened prefill valve to the prefill tank.

In the main return valve block is a unit labeled NIV. This is a non intensifier valve. It is a safety measure to prevent serious damage to the press in case the return outlet valve fails to open at the proper time. If that happened, and high pressure were available in the main cylinders, the pressure in the return cylinders could conceivably be intensified to 50,000 psi. With the NIV unit however, an excess of a few hundred psi above the normal 4500 psi would overcome the spring pressure of the NIV and permit the water to return to the accumulator lines.

High Pressure Shut Off

The use of a high pressure shut off valve is another safety feature. Any abnormality of operation could be conveyed electrically to the solenoid of the air valve of the shut off valve pilot system, which would act to introduce pressure at port (b) of the shut off

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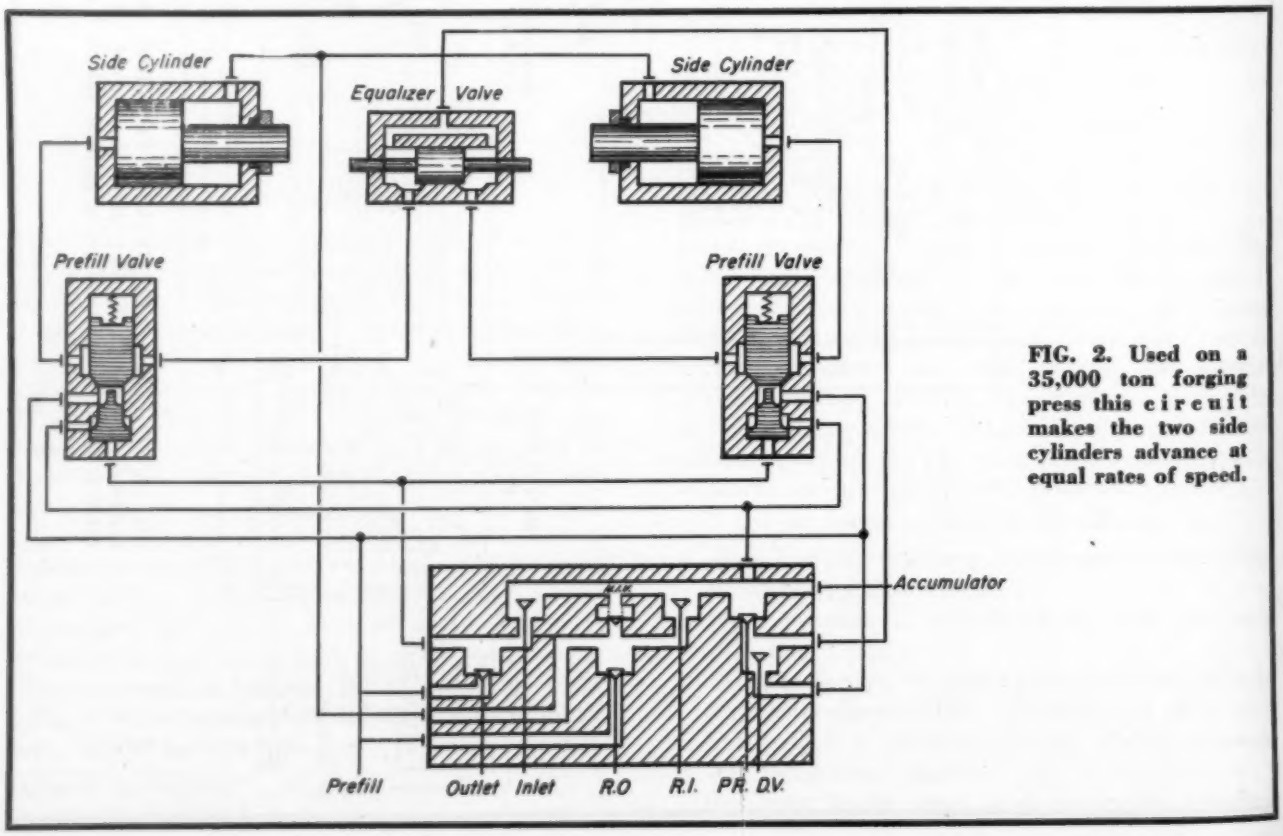
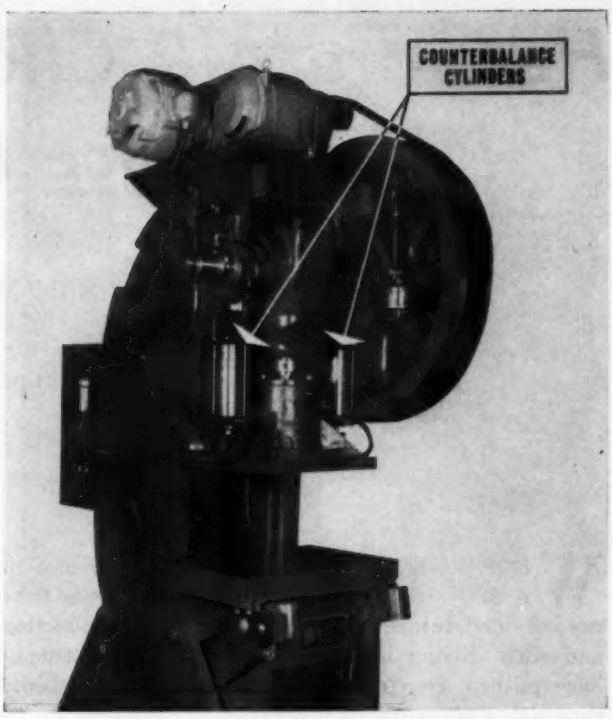


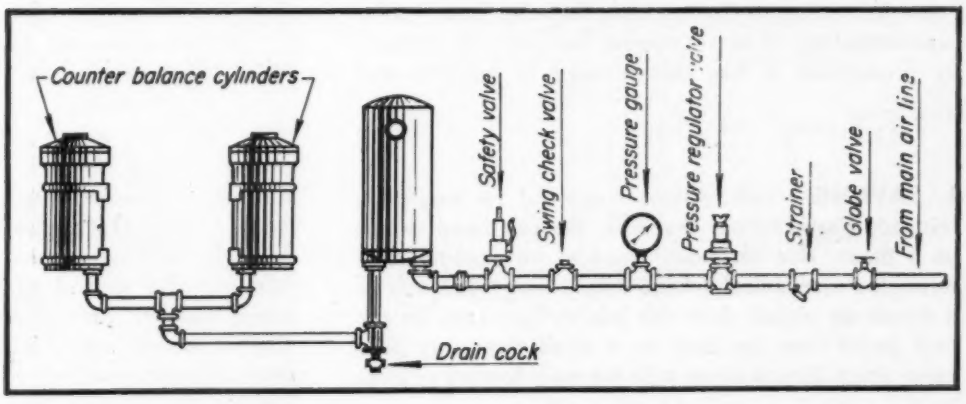
FIG. 2. Used on a 35,000 ton forging press this circuit makes the two side cylinders advance at equal rates of speed.

PNEUMATIC COUNTERBALANCING of Mechanical Presses



INSTALLATION of counterbalancing cylinders on a 100 ton mechanical press.

Courtesy The Federal Machine and Welder Co.



PIPING SCHEMATIC for installing an air counterbalancing system. Standard single acting cylinders are used.

Courtesy E. W. Bliss Co.

IT'S a simple job to install a counterbalancing system on mechanical presses in your shop. The system will save wear and tear on the press clutch and on tooling. To make the installation, it will take a little ingenuity in arranging mounting brackets and some air circuit "know-how."

Single acting air cylinder having a stroke sufficient to take care of the press stroke adjustment are used. Diameter of the air cylinder depends on the weight of the press slide and attached tooling, and the air pressure in the system. Cylinder selection is based on the familiar force equals pressure x area relationship.

In your air circuit, which is supplied with air by the shop compressor, you'll need a globe valve for on-off control, a strainer, pressure regulator, pressure gauge, check valve, safety relief valve and an air storage tank.

Air pressure is controlled by the regulator. If a heavier die is to be used, more air can be forced into the tank and for a lighter die a small amount of air is allowed to escape. In operation there is no appreciable loss of air in the cylinder.

Size of the air storage tank should be sufficient to absorb the discharge from the counterbalance cylinder during the full stroke of the press. On short stroke presses, the air tank is sometimes omitted and the air is pushed back into the main air line at each stroke of the press.

On a typical installation in a press room, a 1900 pound slide and tooling are counterbalanced by two six inch diameter cylinders. The press stroke was six inches with five inch adjustment; therefore, 12 inch stroke cylinders are used. Shop air is regulated at 40 psi when the press slide is up. Compression of the air as the ram descends raises this pressure to 42 psi. The surge tank on this press is 10 inches in diameter and 30 inches high. Its size was determined to give 2 psi differential during compression.

Here are AIR CIRCUITS that Reduce Manual Operations

We know that it's not likely that you run a woodworking shop. But we're just as sure that you'll get some good ideas from the experience gained by the use of these simple air circuits on woodworking machines. The circuits can be easily applied to machines in many industries.

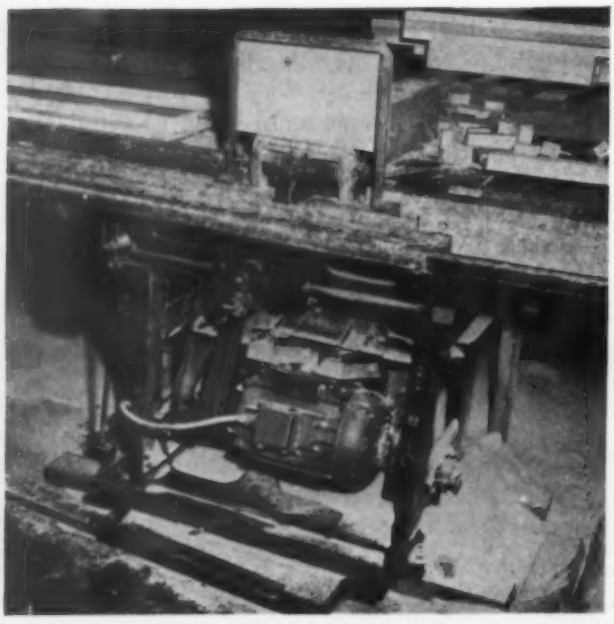
WOODWORKING is an old, old art. Because it is old some of its machines and methods have needed moderninzing to keep pace with production and costs. Rising labor costs and increased demand have pushed shop managers to make their machines turn out more work in less time.

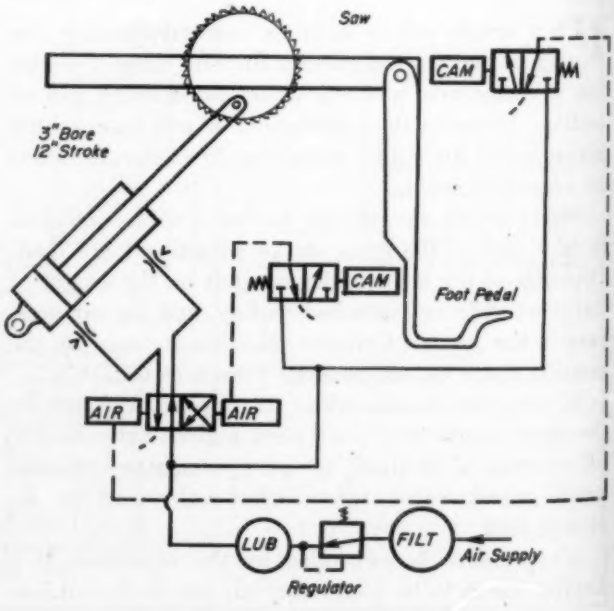
Since 1944, the Superior Sash Company in Toronto has revamped their shop machines by augmenting foot and hand operating levers with air power circuits. According to Norm Hope, Superior Sash's shop superintendent, "The revamping has not only stepped up production. It has also resulted in uniform and better quality production. Initial cost of the air circuits was quickly paid off. Working with Andy Damer of the John Spotton Co., Ltd., we built simple air circuits into machines which had already seen many years of service in our shops."

Increased use of air power necessitated greater compressor capacity. The shop's original 1 ½ hp air compressor which supplied air for blowoff and for the sprinkler system couldn't handle the new load. Compressor capacity adding 6 ½ hp has been installed.

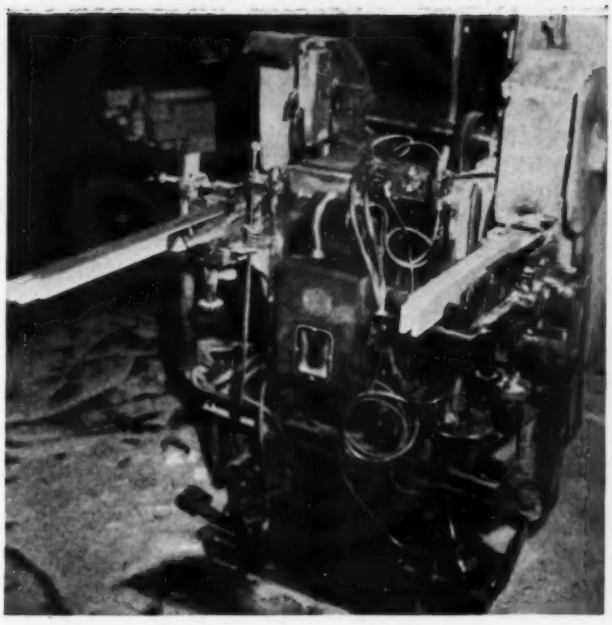
The accompanying photographs and sketches illustrate how each of the operations is air powered.

1. SAWING—Sash members are cut to length on this cutoff saw. To cut the work, the saw head swings on a pivot. This movement used to be accomplished through a mechanical linkage with a foot treadle. Now a simple air circuit does this job. A light step on the foot pedal trips the cam on a small three-way pilot valve which directs air to shift the main four-way valve. Air is then directed through the four-way valve to the head end of the air cylinder which swings the saw head. Completion of movement of the saw head causes tripping of a second pilot valve to reverse the main valve. Air then goes to the rod end of the air cylinder. Speed control valves in the air lines to the cylinder rod and head ends are adjusted to control the speed.

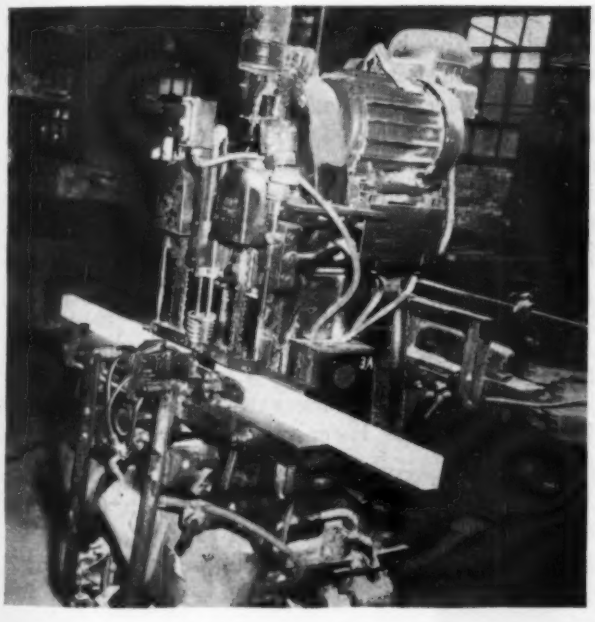


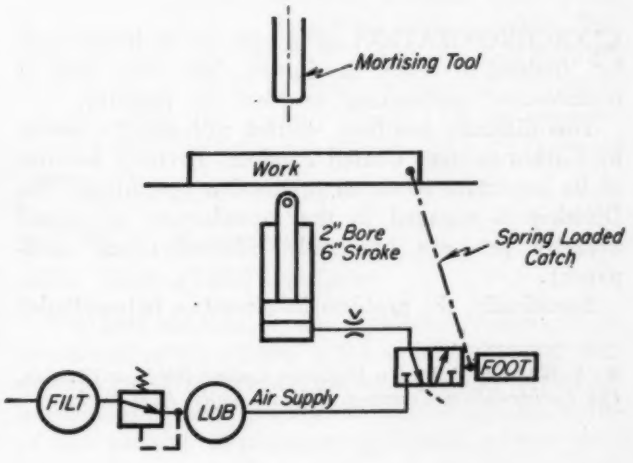


2. SLOT JOINING—Ends of window sash members are slotted on the two machines shown in the photograph. The slotting cutter heads are actuated by the same air circuit used on the cutoff saw. This circuit, using cam operated pilot air valves to do the work, replaced a mechanical linkage which required considerable effort from the operator.

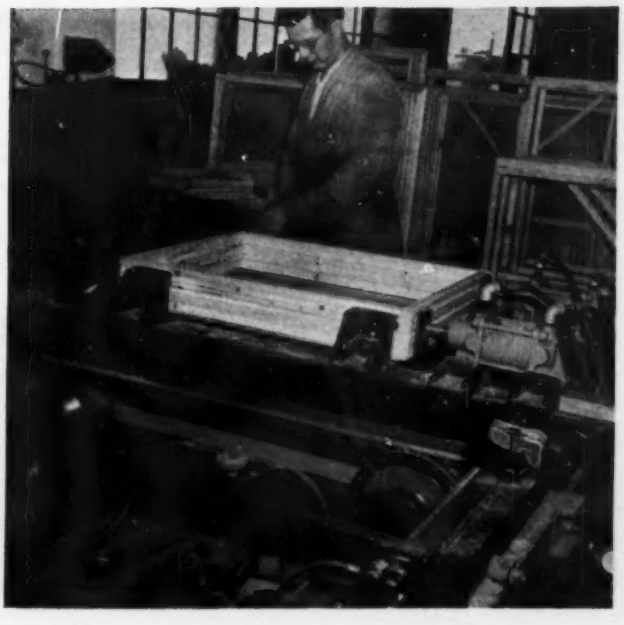


3. MORTISING—Sash members are mortised on the machines shown here. Like the slot joiners, two machines are placed back to back. An air circuit is used to feed the work into the chain mortising tool. A single acting, gravity return air cylinder having a two inch bore and six inch stroke is used. Stepping on a foot pedal shifts the three-way valve to direct air pressure to the cylinder. When the table has reached a given point, the spring loaded catch is pulled free to shift the air valve to the exhaust position.





4. FRAME CLAMP—Final assembly of the window frame is done on this frame clamp. In the foreground, two diaphragm type air clamps are seen. These 11 inch diameter, single acting air clamps have a three inch stroke. Hose connections from the clamps are seen connected to a quick exhaust valve. Two 4 inch bore double acting cylinders are mounted on the upper rails at the right. A four-way two position valve and a sequence valve in the air circuit controls the movement of the cylinders. The two double acting cylinders close first and then air pressure opens the sequence valve to move the diaphragm clamps. Use of the large clamp cylinders provides a clamping force for 2900 pounds at 80 psi line pressure.



A Method of SYNCHRONIZING HYDRAULIC CYLINDERS

In Carborundum's plant this method has reduced production rejects and increased the life of the machine.

By W. E. Hallatt

SYNCHRONIZATION of a pair of hydraulic cylinders to move in unison, has long been a troublesome engineering problem in industry.

This difficulty has been studied with much concern by Carborundum's Coated Products Division because of its important effect on production operations. The Division is engaged in the manufacture of coated abrasive products (generally referred to as sandpaper).

Specifically, the problem involves two twin-cylinder hydraulic presses. The presses are used to splice coated abrasive belts (see Figure 1) which find extensive use in the grinding and polishing of stainless steel, sheet steel, aluminum, etc., flat stocks up to 72 inches in width. For each of these applications, a smooth splice and a straight belt are mandatory, and it is in this respect that improper operation of the presses caused an excessively high percentage of rejects.

W. E. HALLATT, Design Engineer, Coated Products Division, The Carborundum Company, Niagara Falls, New York

Simple Press Circuit

Each of the presses is powered by a single hydraulic power unit and is actuated by a four-way, two-position hand valve. Throwing the valve causes the two cylinders to raise the lower platen on which the splice

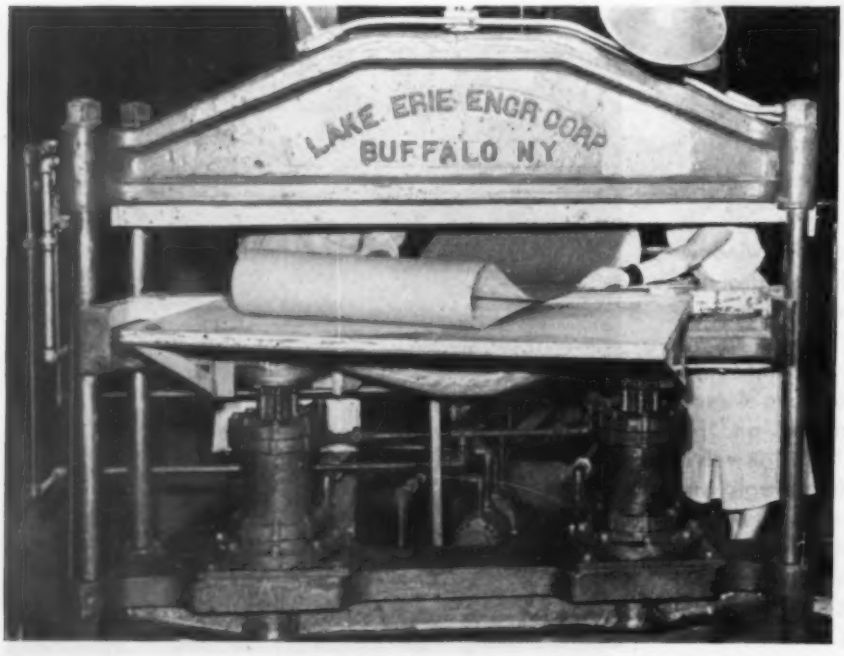


FIG. 1. Hydraulic presses used to splice coated abrasive belts. Movement of both lift cylinders is synchronized by the pair of fluid motors seen on the floor behind the cylinders.

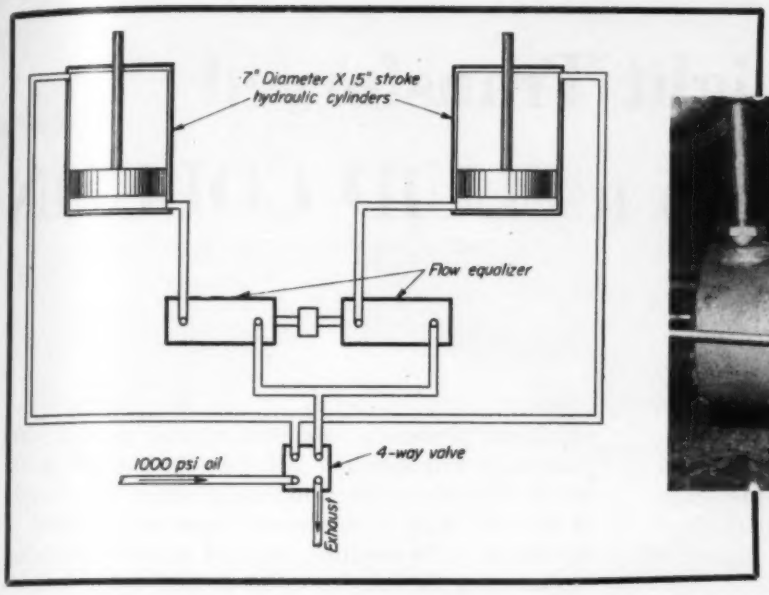


FIG. 2. Simple control circuit for the press.

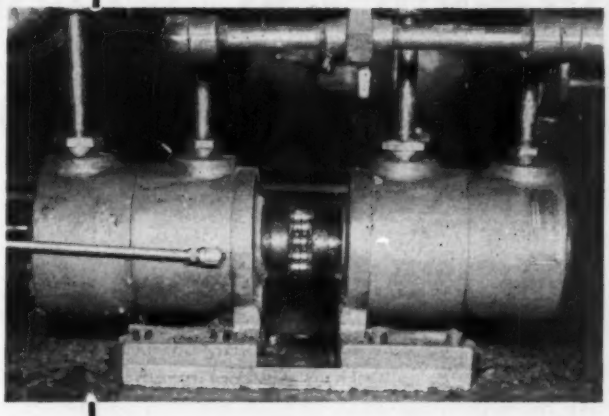


FIG. 3. Closeup of the equalizing motors.

has been placed, thus closing the press and applying the proper pressure to the splice.

It is here that trouble arose. Following each yearly overhaul, the mechanical action of the machine was flawless. After a very short run-in period, however, the press would begin to close unevenly. When the control valve was thrown, one of the cylinders would start to move before the other and continue out of position until the press closed.

At times, this uneven action continued increasing as the press closed so that the lower platen would be tilted when it arrived at the closure point. The closed side of the press would then stop while the other side followed along.

Such uneven action caused extreme bearing and column wear, resulting in high maintenance costs. As time passed, this wear often caused reversals in the press error, so that the cylinder that started out first did not always arrive first.

Uneven Closing Affects Quality

Quality of product was also affected. The action of one side of the press closing before the other produced a slight lateral sliding of the platens in the final moments of closing, which in turn often caused a sliding action between the two pieces of the freshly glued splice. Thus, two defects occurred—the belt was slightly crooked and the splice was thinner at one end than the other, because of the concentrated impact it received initially, when the one side closed on it.

A splice that is uneven from side to side causes vibration and chatter on grinders and polishers, thereby producing an inferior surface finish and reduced belt life.

Several methods were considered for eliminating this erratic press operation.

One of these was the familiar tandem rack and pinion with pinions coupled to the same shaft so that both racks would be forced to move together. This method, although effective, involves considerable mechanism, and must be carefully guarded. The safety guards reduce the overall efficiency of the machine, because of the added inaccessability, and are therefore undesirable.

Oil Flow Equalized with Two Fluid Motors

The best solution to the problem appeared to lie in controlling the oil flow to the cylinders so that each cylinder received exactly the same volume of oil regardless of pressure variations. Accordingly, the shafts of two positive displacement hydraulic motors were coupled together so they would turn at the same speed. This meant that any oil passing through the one motor was matched by an equal volume of oil through the other.

The diagram, Figure 2, illustrates how the motors were piped into the circuit beyond the hand valve, with the oil being forced to pass through a motor on its way to a cylinder. Figure 3 is a closeup view of the installation.

With the two motors coupled together, the cylinders move in perfect unison and the uneven action is prevented. The pressure on the two cylinders is not equal at the moment of closure, but there is sufficient leakage through the motors when stopped to equalize the pressure in less than a second.

The results are gratifying. Not only have rejections due to "slipped and tapered" splices stopped, but the action of the presses has been so smooth that no appreciable column wear has been observed in one year of operation.

It is estimated that the time between major overhauls has been at least doubled and perhaps extended indefinitely.

Freight Car Weight Transferred to a FLUID COLUMN

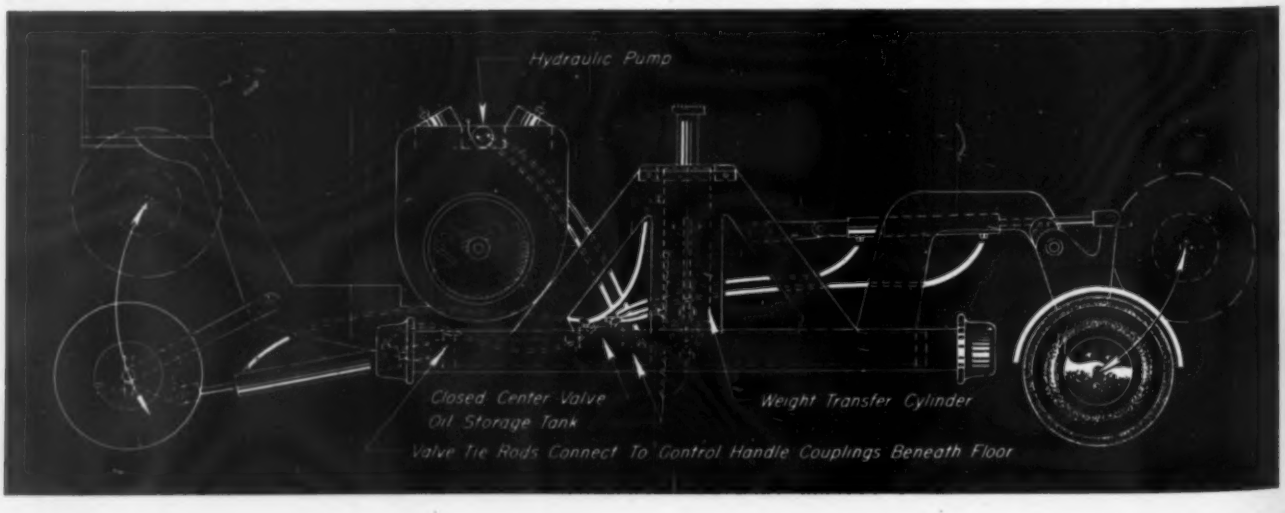
BY MEANS of a hydraulic lift, the 1-¼ ton Hemco-Motive can switch and spot freight cars weighing more than 360 tons. It takes traction and leverage to do this big job. Needed traction is always on the four driver wheels because the hydraulic lift transfers freight car weight to the wheels.

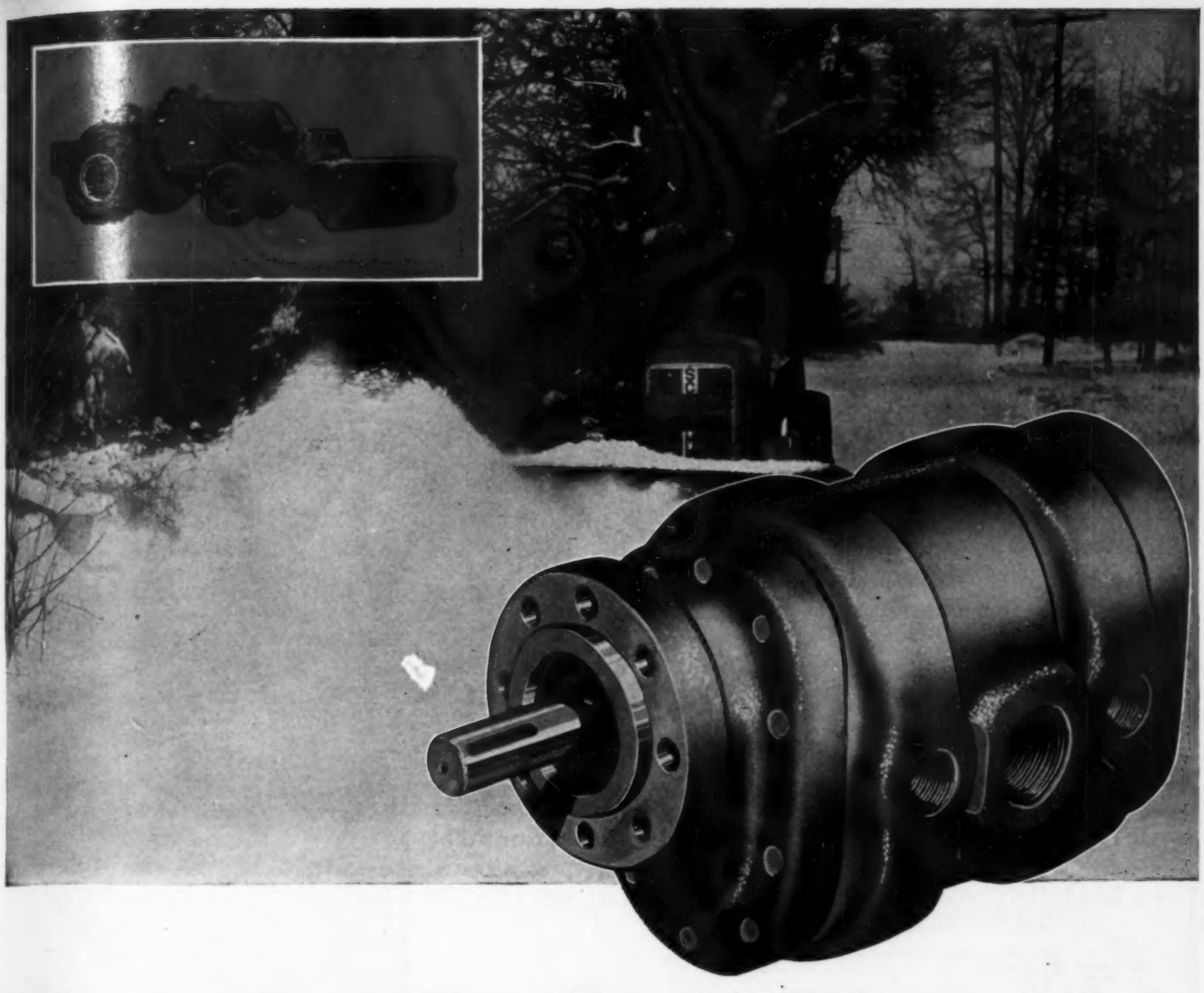
While the weight of the freight car is being transferred onto the locomotive, the operator watches a pressure gauge, which is calibrated in tons. The operator holds the valve open until the gauge stops moving. He has at that time, lifted and of course transferred all of the weight necessary and is now ready to engage the motive power to relocate the car. The machine is equipped with a 25 hp air-cooled engine, which will produce a maximum drawbar pull of 7400 pounds. A rail speed of 150 feet per minute is obtained through worm reduction gearing. The weight of the car being a downward force and exerted in the center of the machine, the load will stay put without harming the coupler of the freight car.

Four Cylinders Are Controlled

The hydraulic system consists of a four plunger, double acting valve, which controls the four cylinders. This control valve has a built-in differential, adjustable, relief valve. The control valve in neutral position blocks the return of the oil, thus holding the cylinder in position. One cylinder operates the lift, which transfers the weight of the car to the machine, giving the machine sufficient traction for moving the load. The other cylinders are for the raising and the lowering of the front and rear wheels and finally a cylinder is used for the power steering. The hydraulic pump is driven off the timing gear of the gasoline powered engine, through a flexible coupling, directly to the shaft of the pump. This design, developed by Hemco Manufacturing Inc., eliminates the necessity of a V-belt or chain drive.

OIL POWER is used to raise and lower the rubber tired off-the-track wheels, for power steering, and to power the weight transfer cylinder. By actuating a 4-way closed center valve while watching a pressure gauge, the operator transfers weight of the freight car to the hydraulic cylinder.


Hydraulic Pump
Closed Center Valve
Oil Storage Tank
Weight Transfer Cylinder
Valve Tie Rods Connect To Control Handle Couplings Beneath Floor



Winter Gets The Brush Off !

THIS HEAVY DUTY service "Commercial" double oil hydraulic pump develops fluid power to flex the muscles of the fluid motors which operate the brush equipment mounted on this tractor. The entire mounting is as clean as the cleared road which is left.

Two separate pumps, assembled into a single unit, are driven by one through shaft to which the primary driving power is applied. Safe operating pressures up up 1000 p.s.i. can be developed with one pump having ample capacity to raise and lower the cylinders, while the other pump maintains uninterrupted rotation of the fluid motor which turns the brush.

Here again is an application of fluid power controls giving a simplified, lower cost installation when compared to any other method of power transmission. You will find that there are "Commercial" oil hydraulic pumps, motors, valves, and cylinders giving dependable service and working near you.

"COMMERCIAL"

"PRODUCTS PREFERRED BY CUSTOMER ACCEPTANCE"

THE COMMERCIAL SHEARING AND STAMPING COMPANY

YOUNGSTOWN, OHIO CHICAGO, ILL. SALT LAKE CITY, UTAH

PUMPS · MOTORS · CYLINDERS · VALVES

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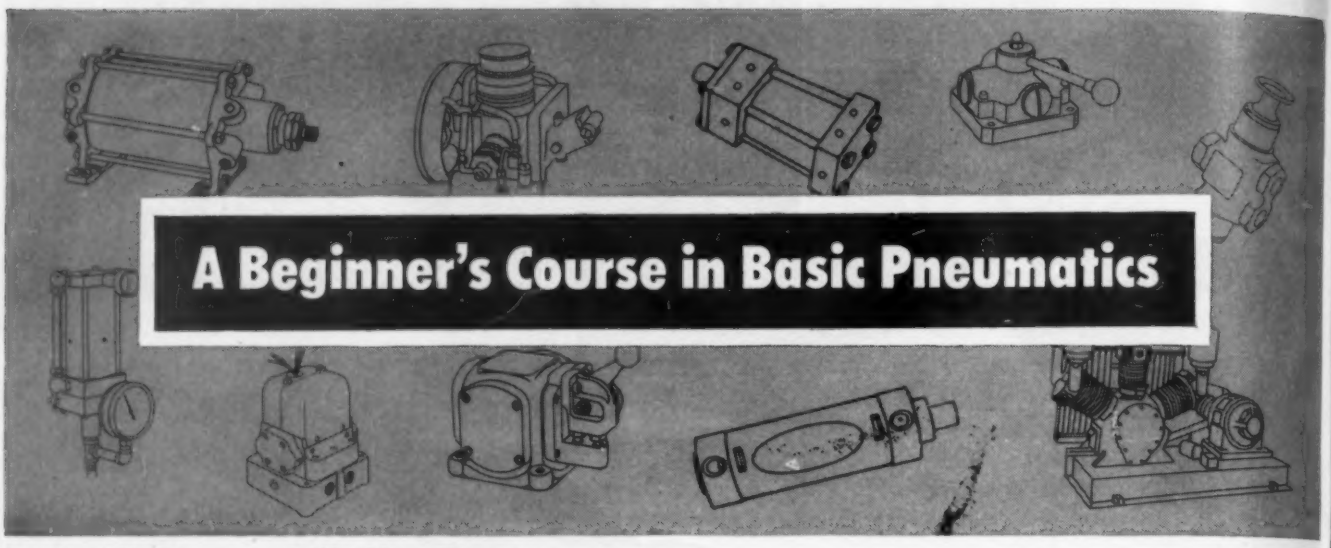


Section III Power and Working Elements

Air Valves

Part 5

Introduction (Cont'd)

Flow Control Valves

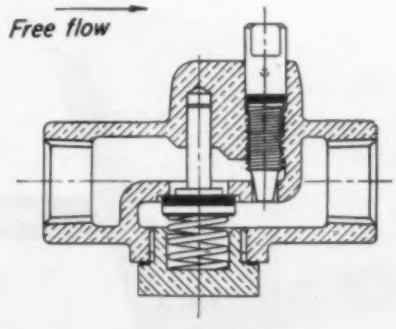
IN this preliminary discussion of the basic types of air valves our purpose is to mention a few of the major, common types. We have briefly identified the major selector or directional type air valves. We will now look at two other basic types: flow control and pressure control air valves.

Flow control air valves are those designed to control the speed of the piston stroke of a cylinder. Such valves allow free, full flow in one direction and an adjustable or controlled flow in the other direction. Since flow control valves control the speed of the piston in one direction only, such valves are mounted near the exhaust port of the controlled cylinder. For the control of exhaust flow, a needle or long-tapered valve stem, externally adjustable, can be preset for any flow from zero to full capacity.

Graduated flow is preset by varying the orifice through which the return air passes. Control of flow controls the speed of air being exhausted and therefore the speed of piston movement. For this reason flow control valves are just as often called speed control valves. Power of the cylinder is not affected by flow control valves. Both poppet and ball check type flow control valves are in use.

Flow control valves are habitually installed between the operating (directional) valve and the exhaust port of the cylinder. For best results it is good practice to install flow control valves close to the exhaust port. This has influenced the design of flow control valves which, in general, are small and compact since most installations are line installations. Normally, the valve is only large enough to contain the poppet or

Fig. 1. A POPPET design, line type speed control air valve. The design provides for full air flow towards the cylinder and controlled air flow away from the cylinder.



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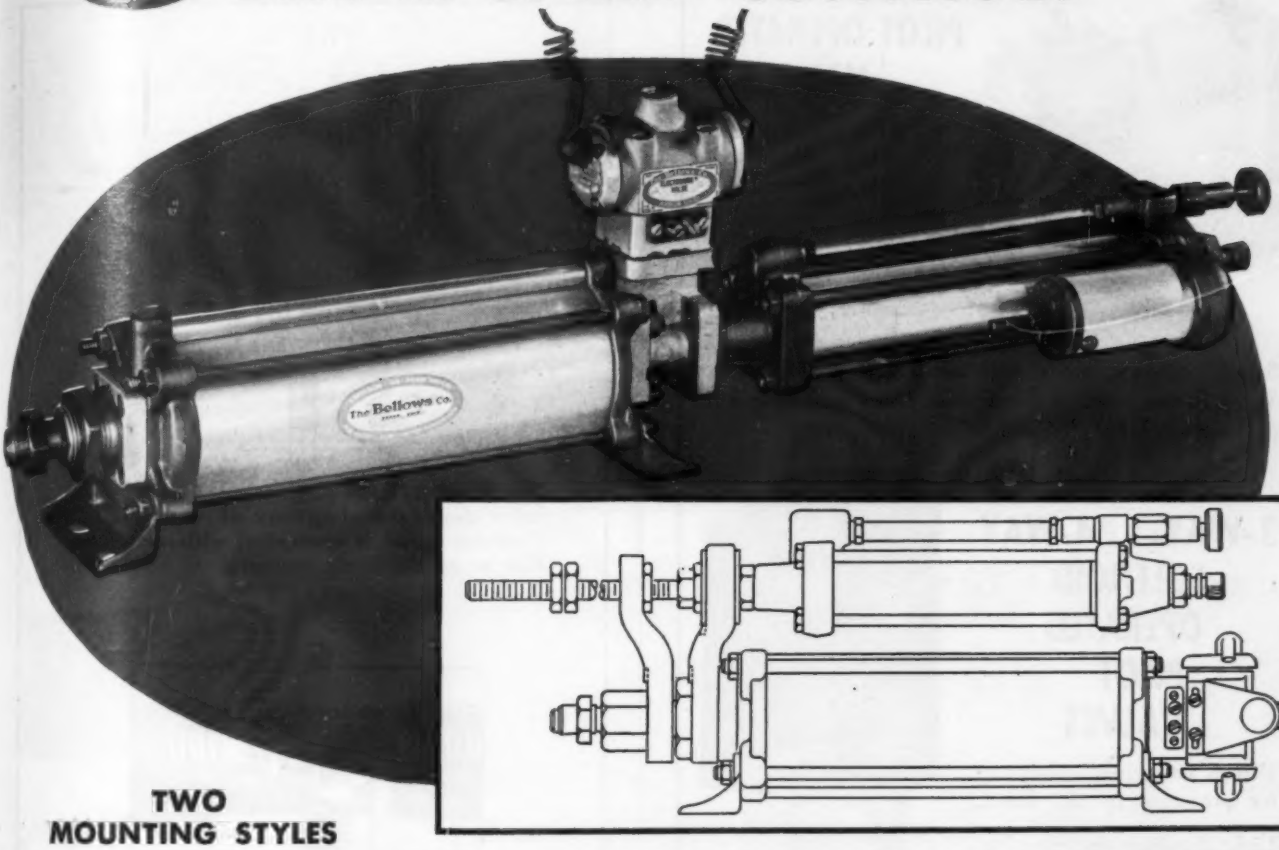

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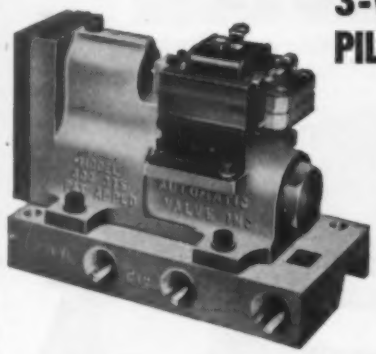

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ball check, full pipe size ports and a seat for the adjusting needle, screw or tapered stem.

When speed control for a double acting cylinder is required in both directions two flow control valves are used, one on each of the lines leading to the cylinder ports. When two such valves are used, each valve controls the piston velocity in one direction, independently of the other speed control valve. Such an arrangement makes it practical to operate a double acting cylinder at different speeds in each direction.

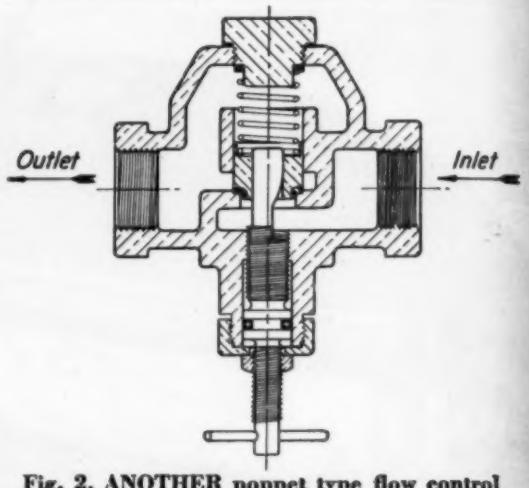

Fig. 2. ANOTHER poppet type flow control valve shows the simplicity of construction. Cylinder speed is controlled without reduction in available air pressure.

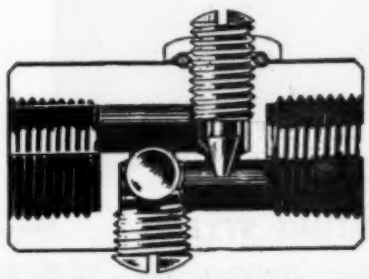

Fig. 3. A FLOATING ball check type flow control valve. In this design air flow is upward through orifice. The "O" ring under angular compression assures a leakproof seal.

Various types of speed control are practical with flow control valves. The commonest application is exhaust speed control for double acting air cylinders. The valves should be connected in the line to the cylinder so that the outward side of the valve is away from the cylinder. The speed of piston movement is controlled by controlling the exhaust flow rate. A fast forward or outstroke and a slow or controlled rate of return is obtained in this way. Figure 4, A shows a simple exhaust speed control for a double acting air cylinder.

By placing the valve at various distances from the cylinder the volume of compressible air on the exhaust side of the cylinder can be increased or decreased. This fact can be utilized on a long stroke

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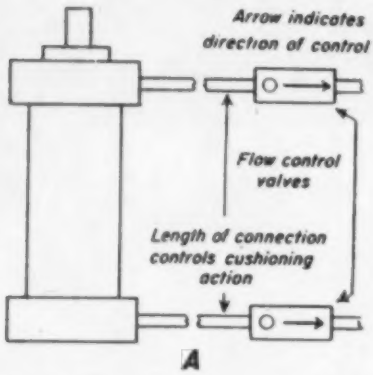
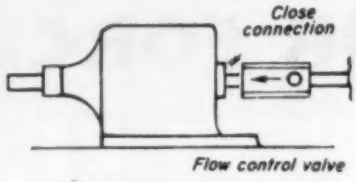


A



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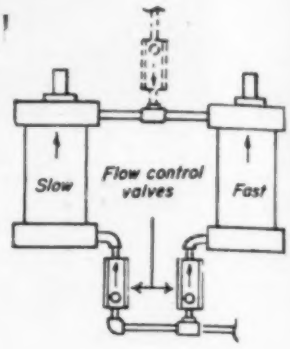
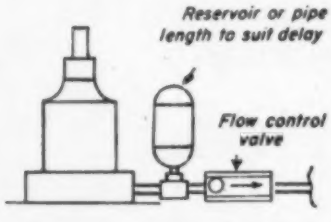


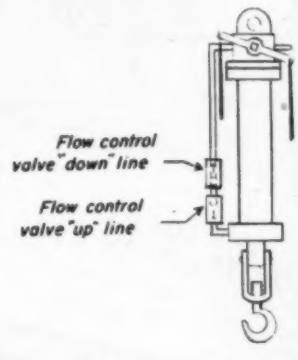
C

Fig. 4. TYPICAL flow control applications: A—exhaust speed control for double acting cylinders. Rapid forward piston movement and reverse movement at a decelerated, controlled rate is a common application; B—speed control for a single acting air cylinder. Unless a volume of compressible air on the exhaust side of the cylinder is required for a specific control action, the flow control valve should be installed close to the cylinder; C—Speed control of cylinders in parallel. Variable forward speed control of two cylinders connected in parallel through the same selector valve is easily obtained through individually preset separate flow control valves; D—Delayed return control for single acting, spring return air cylinders. This application requires a surge tank or its equivalent in volume of exhaust line, the rate of control of the exhaust volume determining the delay time; E—Two-way speed control of air hoist. Two flow control valves, arranged back-to-back, control both "up" and "down" rates and allows a simple arrangement of piping and selector valve.

D



E



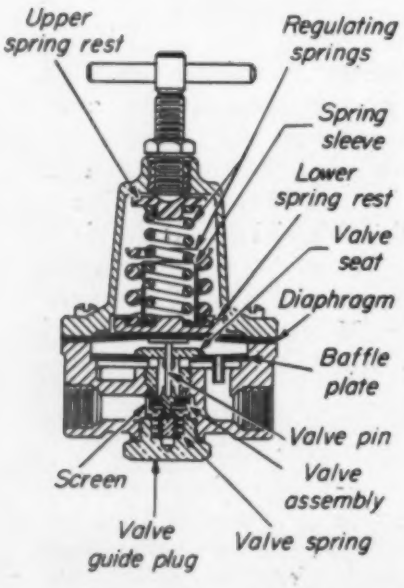


Fig. 5. A SINGLE SEATED, direct acting, diaphragm type pressure regulator or pressure reducing valve. A regulated lower pressure delivered to the cylinder is constant regardless of fluctuations in the high pressure side line.

cylinder to give a desired decelerating effect. For most speed control applications, best results are obtained by installing the flow control valve close to the exhaust cylinder port. Figure 4, B shows this recommended relationship. Two flow control valves, back-to-back will provide both forward and return control.

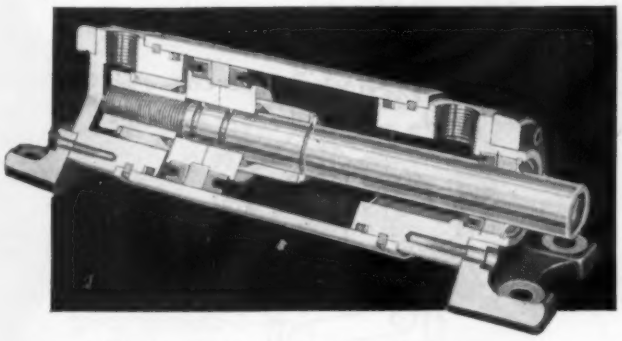
On an application where two double acting cylinders are connected in parallel through the same selector valve, it is practical to obtain variable forward piston speeds, connected as shown in Figure 4, C.

In applications of single acting, spring return air cylinders where delayed return of the piston is required, a surge tank or a comparable line connection can be utilized to provide a volume of air which the flow control valve can exhaust at a controlled rate to provide the exact time delay required. Figure 4, D illustrates a very simple arrangement to provide delayed return.

A two-way speed control for an air hoist is simply and effectively provided by flow control valves. Installed as shown in figure 4, E, the lower valve controls the "up" stroke speed, the upper valve the "down" stroke speed. Speeds in both directions are independent of the selector valve.

Pressure Control Valves

Pressure regulators are required on most air circuits to insure that the cylinder received the exact



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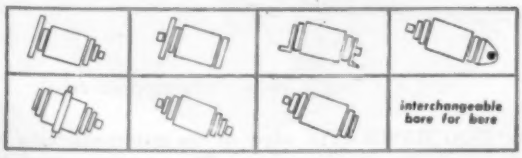

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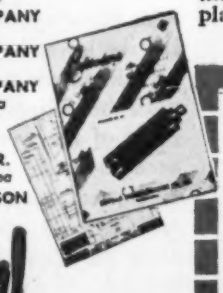

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pressure required for the most efficient operation.

We will look at two types of pressure regulators. Figure 5 is a single seated, direct-acting diaphragm type pressure regulator. The large area neoprene diaphragm reduces higher inlet pressure to a lower pressure which is constant regardless of fluctuations in the high pressure side of the line. An adjustable screw is used to compress a pressure spring against a pressure plate and a diaphragm. Functioning in a manner somewhat similar to a relief valve, the piston opens when the incoming air overcomes the pressure spring force. Settings are made by pressure gauges. Many pressure control valves are furnished with gauges as standard equipment.

The second pressure reducing valve, shown in Figure 6, is an automatic cam operated type. This valve is normally in the "release" position with supply pressure on top of the inlet ball valve and delivery vented

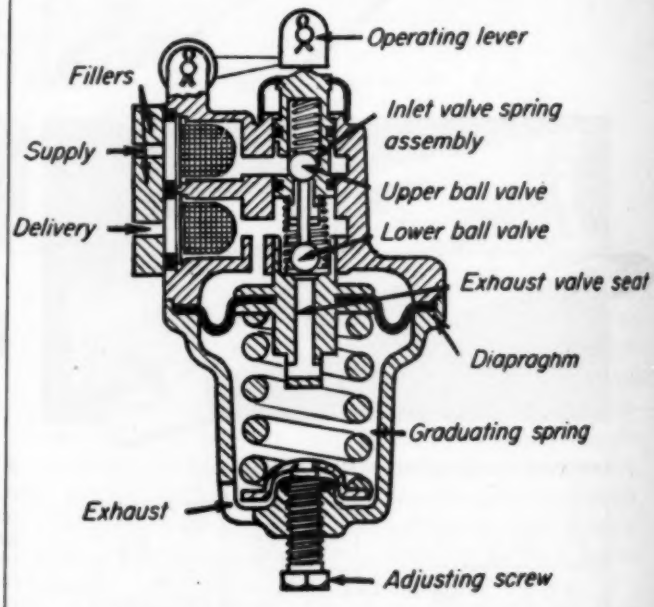

Fig. 6. DIAGRAMMATIC view of an automatic cam operated pressure reducing valve. The movement of the inlet valve spring housing, down under supply air pressure and up under graduating spring force, supplies the proper pressure to the delivery port.

to atmosphere past the exhaust ball valve.

When the operating lever is moved downward, the inlet valve spring housing is carried downward, seating the lower ball valve on the exhaust valve seat. Supply air passes the upper ball valve to the delivery port until the delivery pressure, as determined by the movement of the operating lever, is reached. As air pressure above the diaphragm is increased, the diaphragm is forced downward, compressing the graduating spring. This action allows the inlet valve spring to close the upper ball valve against its seat, cutting off the flow of supply air.

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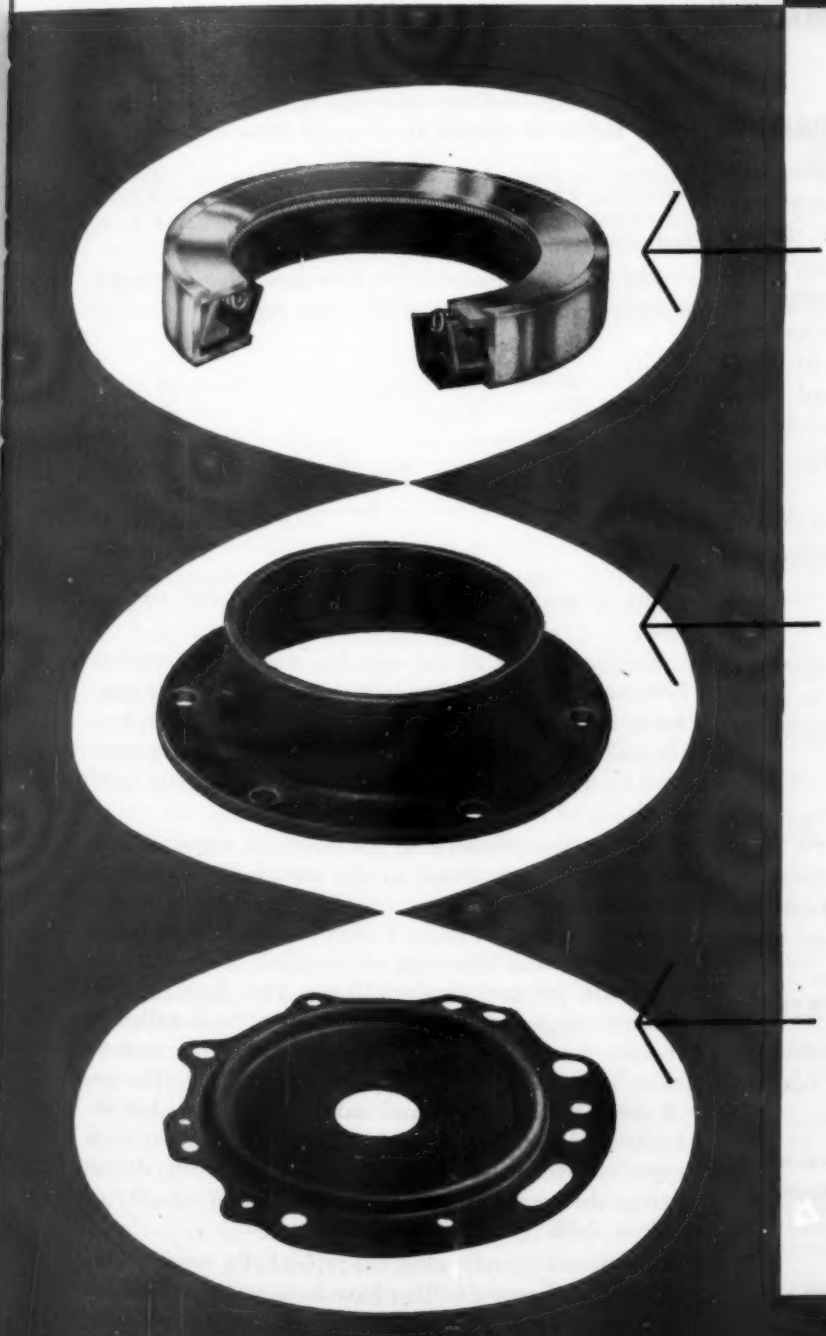

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the diaphragm also decreases and the graduating spring assembly will move upwards and open the inlet valve in an effort to restore proper delivery pressure. When this pressure is restored, the graduating spring assembly will again lower, allowing the inlet valve to reseat.

As the operating lever is moved to release, the inlet spring housing moves upward; the upper ball valve is held in its seat by the inlet valve spring. This lifts the lower ball valve from its seat, venting excess pressure in the delivery port to atmosphere through the spring chamber. When the pressure has been reduced to the desired delivery pressure, the graduating spring will raise the diaphragm and the exhaust valve seat against the lower ball valve, cutting off further venting. Temperature variations which may change the pressure in the delivery port line will cause automatic valve action to restore the correct pressure.

Illustrations supplied through the courtesy of the following companies: C. A. Norgren Co.; Hannifin Corporation; Modernair Corporation; Ross Operating Valve Company; and Westinghouse Air Brake Company.

The next installment in the February issue will begin a more detailed survey of air valve types.

4 Ways to Use Air

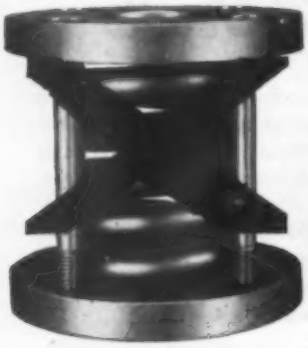
Continued from page 67

group of grain drill parts being lowered into the dip tank.

Cable attached to the cylinder rod is connected to both ends of the load unit through a pulley arrangement. As the cylinder is extended the cable rides over the pulleys and lowers the parts. The air valve is operated by a stirrup type control hung at convenient head level.

A fourth application of air power is cited to illustrate another advantage of the use of air. This is to increase the usefulness of a standard tool by making it easier to operate. Figure 4 shows an eight foot radial drill which was idle most of the time because it was a difficult job to lock the column. The plant superintendent suggested that an air cylinder be installed to replace the hand operated locking lever. The control valve is located near the spindle control lever. The use of the cylinder to lock and unlock the column has actually added several machine hours daily to the drill capacity of the shop. Adding the air locking device brings the machine close to the production capacity of lighter drills.

The four examples cited are typical of a considerable number of operations that have been converted to air. In a plant where the size and shape of parts made handling an important cost factor, air power has proven a profitable investment. Added to the fact that easier and faster operation has reduced unit production time and



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in the process reinstated older machines to newer, higher schedules and relieved serious fatigue problems for operators, air power at Minneapolis-Moline has won an established place for itself.

Control Circuits for Heavy Presses

Continued from page 87

valve thereby shutting off the supply of high pressure water to the press.

The throttle valve is used for speed control.

There are two selector valves in a selector valve block. They are used to supply water either to the main or side cylinders or both. Pressure stages of 4000, 3000, or 12,000 tons are thereby available. The valves are controlled by solenoid operated air valves which control the action of an air cylinder; the latter actuating the spindle of a hydraulic three-way valve which prevents or admits the introduction of pilot pressure to the selector valves to control their position.

The circuit shown in Figure 2 is used to make the two cylinders shown, advance at equal rates of speed. The circuit is used on the Loewy 35,000 ton forging presses. The cylinders must advance uniformly to pre-

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clude the possibility of forging a shape which does not completely fill the contour of the die cavity. The prefill and pressure circuits are identical in operation to those described previously, except that in this case all the valves are housed in one block. The additional feature, is the use of an equalizer valve.

Pressure water from the control valve is introduced to the equalizer valve and then goes to prefill valve and cylinder. If one cylinder moves faster than the other the spindle of the equalizer valve is shifted in the direction of throttling the flow to that cylinder while simultaneously increasing the port opening to the other. A precise degree of control is thereby obtained.

The salient features in the circuits described are primarily in the use of "custom designed" valves. A considerable latitude is afforded the designer when the valves may be designed to fit the requirements of the circuit rather than building a circuit around available commercial components. A second consideration is the stringent requirement for safety of operation especially in the event of failure of any component of the hydraulic system. A few remarks have been made here in this connection. However, this problem has become of prime importance recently in the design of the giant presses for the Air Force. The huge tonnages involved, and complexity of design required that the problem of safety be handled as a major subdivision of design. Some aspects of this problem will be discussed in the next article.

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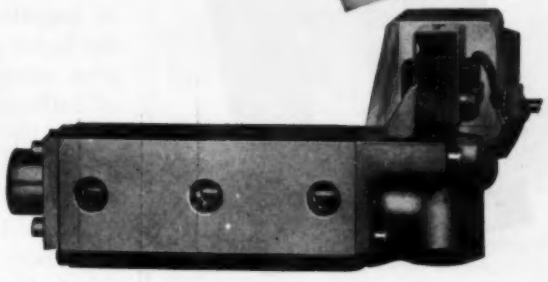

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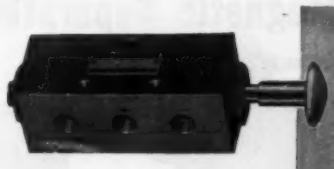

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Push-pull or push and spring return operation — ⅛" and ¼" tapped connections. Widely used for controlling cylinders and many other applications. Air to 125 psi — vacuum—can also be used in low pressure hydraulic service.

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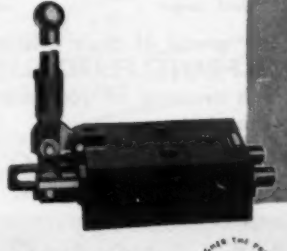
Two position or three position valves ½" to 1½" sizes for line pressures 1000 to 5000 psi. Can be furnished in neutral, compound-exhaust or compound-on actions. Pilot cylinder operated types available up to 4".



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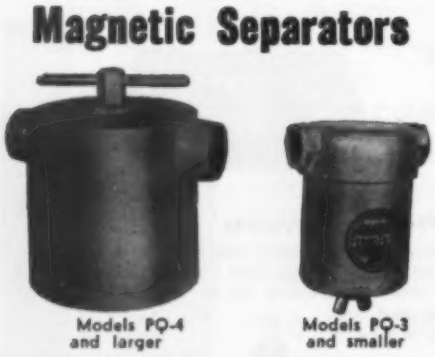
Write for Bulletin PM-65

Here is full information on how the FRANTZ permanent magnet FERRO-FILTER removes ferrous particles from fluid power lines protecting pumps, valves, controls, cylinders, gears and other hydraulic components subject to wear. The bulletin tells how to minimize maintenance, downtime and parts replacement by using FRANTZ

FERRO FILTER

Magnetic Separators



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Manufacturers of Permanent Magnet and Electromagnetic Separators

National Fluid Power Association Gets Off to Good Start

THE National Fluid Power Association held its first regular semi-annual meeting at the Hotel Sheraton, Chicago, on October 6 and 7. About 150 representatives of manufacturers and suppliers in the hydraulic and pneumatic industries attended. With a high level of enthusiasm and a good working spirit, the Association got its program under way in a very commendable manner.

After introductory remarks by Chairman John C. Hanna, vice president, Hanna Engineering Works, the general session on the first morning heard John E. Erskine, vice president, Racine Hydraulics and Machinery, Inc., on "Opportunities for the NFPA"; John J. Pippinger, vice president, Double A Products Co., who discussed Engineering Standards; Elwood G. Peterson, president, Hannifin Corporation who outlined the educational needs of the Association and L. A. Shea, general manager, Air and Hydraulic Division, Lindberg Engineering Co. who spoke on Governmental Relations.

Tell Berna, general manager, National Machine Tool Builders Association, was the speaker at the first day luncheon. He outlined the problems of a trade association from the standpoint of his long association with NMTBA.

Product Section sessions got underway in the afternoon.

The Pump Section under the chairmanship of John E. Erskine; the Valve Section under John J.

John J. Pippinger, chairman of the Valve Section, speaking at the first general session. To his left are John C. Hanna, chairman, NFPA; John E. Erskine, chairman, Pump Section and Barrett Rogers, executive secretary, NFPA.

J. J. Samter, sales manager, Chicago Belting Co.; J. N. Smith, manager, Hydraulic Department, E. F. Houghton & Co., and F. L. Mackin, chairman, Machine Shop and Hydraulics, General Motors Institute enjoy a leisure moment before a session.

R. J. Murphy, manager technical service, Hydreco Division, New York Air Brake Co.; Jack L. Modrich, sales manager, Mechanical Air Controls, Inc.; Mike Modrich, sales engineer, Mechanical Air Controls, Inc.; and Gene Ides, sales engineer, Airdraulic Sales and Service.

William T. Brookins, advertising manager, Hannifin Corp.; Harry H. Adams, vice president, Hannifin Corp.; David Davenport, assistant to sales manager, The S-P Mfg. Corp.; Otto Maha, vice president, Hannifin Corp.; and D. Lee Bassett, vice president-sales manager, The S-P Mfg. Corp. relax at luncheon.

Pippinger; and the Cylinder Section, under the chairmanship of L. R. Burger, sales manager, Logansport Machine Co. Inc. held their first open meetings. Committees were named. Discussions clarified some of the problems that will be given prior consideration by committees for reporting at the next meeting. Interest was sufficient for a separate Accessory Section to meet and discuss their problems.

Education Program

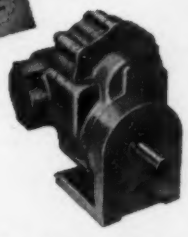
Ben N. Ashton, president, Electrol Incorporated, was chairman of the general session on the second morning. Three speakers covered various phases on the "Education for the Fluid Power Technician." Frank L. Mackin, chairman, Hydraulics, General Motors Institute, reviewed the GM training program in hydraulics; Paul L. Reed, Editor, APPLIED HYDRAULICS, quoted results of a survey on training programs (see October issue, page 154); Professor V. L. Streeter, Director, Fundamental Fluids Research, Illinois Institute of Technology, discussed the new program of hydraulic training set up this year at Illinois Tech. Kenneth B. Anderson, executive vice president, Scientific Apparatus Makers Association, gave some valuable suggestions in his talk, "Your Trade Association."

At the luncheon meeting on the second day, Irving B. Hexter, publisher, The Hydraulics Publishing Co. emphasized that the selling job ahead was going to be a sharp, competitive one and that the man on the firing line would be the critical factor in the growth of the industry.

ADEL *Industrial Hydraulic Equipment*

for PEAK PERFORMANCE ADEL Hydraulic Valves and Pumps are setting new and ever higher standards for precision in manufacturing and efficient performance in operation. Following are but a few of the wide variety of models to meet all operating conditions.

GEAR-TYPE HYDRAULIC PUMPS

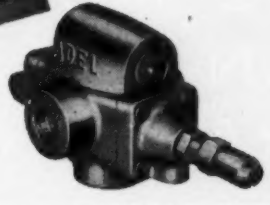


For 1000 psi service with rated capacities at 1800 rpm of from 1.5 to 46.8 gpm.

DIRECTIONAL CONTROL VALVES

4-way valves with spring-centered, spring-offset, and 1, 2, or 3 position detent action. 1500 psi. Flows to 28 gpm.

BY-PASS VALVES



Relief, Sequence and Unloading valves. Direct or remote operation, 50 to 1500 psi range.

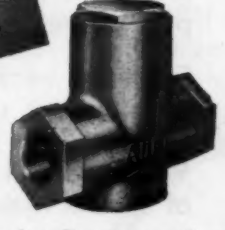
VOLUME FLOW CONTROL VALVES

Compensated type maintains constant flow over wide differential pressure range. No drain line required. 1500 psi.

PILOT VALVES

2 or 3 position detent. With or without dog or lever. Can be used as 4-way valve in small circuits. 1000 psi.

CHECK VALVES



Valves allow free flow in one direction only. Many variations available. 3000 psi.

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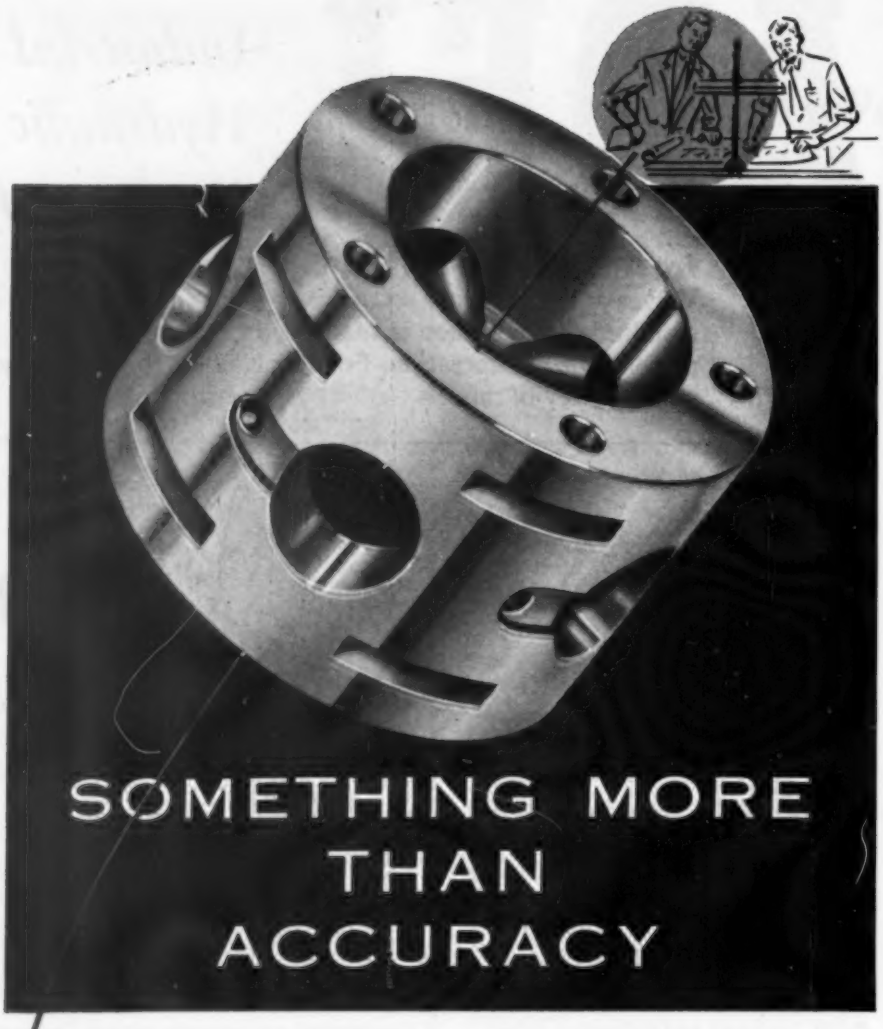

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DESIGNERS AND MANUFACTURERS OF PUMPS • VALVES • ACTUATORS

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NFPA Meeting

Byron E. Snow, manager, Chicago office, Aeroquip Corporation; M. C. McCoy, chief engineer, Berry Division, Oliver Iron & Steel Corp.; B. R. Teree, chief engineer, Aircraft Division, Weatherhead Co.; and Clifton Lovenberg, manager, Hydraulic Division, Pantex Mfg. Corp. listen to a luncheon speaker.

In the afternoon separate sessions on Engineering Standards, under the chairmanship of John J. Pippinger; Education, with Frank X. Cascone, Director, Hydraulics and Pneumatics Division, James L. Entwhistle Co. as chairman; and Government Relations under the direction of J. G. Jones, vice president and general manager, A. W. Cash Co. The Engineering Standards Committee reached preliminary agreements on initial projects including nomenclature and drawing symbols; the Educational Committee agreed that a basic training program, with Pump, Valve Cylinder and Accessory Sections each pre-

L. S. Barksdale, president, Barksdale Valves; C. W. Leidig, industrial division representative, National Pneumatic Co., Inc.; C. A. Pappas, chief engineer, research and development division, National Pneumatic Co., Inc.; and E. G. Peterson, president, Hannifin Corporation caught between sessions.

paring data, was the first job to be done. The objective sought is a basic type of material that could be assimilated first by company organizations, then passed on to customer organizations. The Govern-

ment Relations Committee discussed several standby procedures that were initiated, the objective being

P. E. Roberts, president, Maeward Mfg. Co.; Hugh H. Dorman, president, Powertube Engineering Co. and G. S. Ellis, engineer, L & L Mfg. Co. listen to T. E. Lyon, office manager, L & L Mfg. Co. during a break.

O. G. Lear, president, Fluid Controls, Inc.; Jack McGuire, sales manager, Waterman Engineering Co.; Frank Rousseau, president, Sprague Engineering Ltd. (Montreal); Don Stark, secretary-treasurer, Fluid Controls, Inc., and L. L. Charlson, president, Char-Lynn Co. discuss a common problem.

to form a single body that could represent the industry in all governmental contacts.

The final meeting in the afternoon of the second day was a general session at which all the Committee Chairmen reported. Announcement was made that the spring meeting would be held at Edgewater Gulf Hotel, Edgewater, Miss. on April 6 and 7, 1954.

The National Fluid Power Association held their organizational meeting last May at Bedford Springs, Pa., with 34 initial members. When the fall meeting began a total of 49 members were on record and several additional memberships were approved by the Executive Committee before the end of the meeting. All manufacturers of hydraulic and pneumatic equipment are eligible for membership. Most manufacturers of accessories are also eligible for membership.

CIRCLE SEAL
CHECK VALVE
Manufactured by
JAMES-POND-CLARK
Pasadena 8, California

Parco "O" Rings Insure Positive leak-proofing at high and low Pressure . . .

This CIRCLE SEAL Valve is required to provide millions of cycles of positive leak-proof sealing at high and low pressures. At the heart of this unique valve are Parco "O" Rings selected by James-Pond-Clark for their toughness and ability to withstand abuse, as well as for their workmanship and finish. Tests and field use prove that Parco "O" Rings are outstanding in their ability to provide PERFORMANCE under any severe service condition. Other Parco rubber products used in industry meet the same high standards of Parco "O" Ring quality. All dash numbers of 6227, 6230 and 6290 series for commercial applications or Army-Navy installations to Specifications MIL-P-5516 (6227 and 6230) and MIL-G-5510 (6290) are available from stock. Silastics and other special compounds are available on order.

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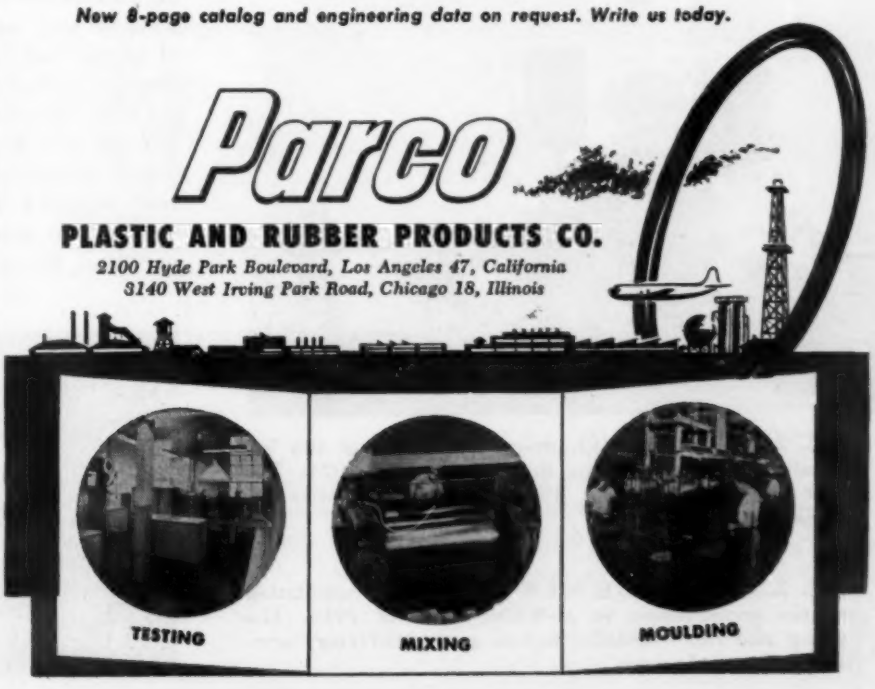

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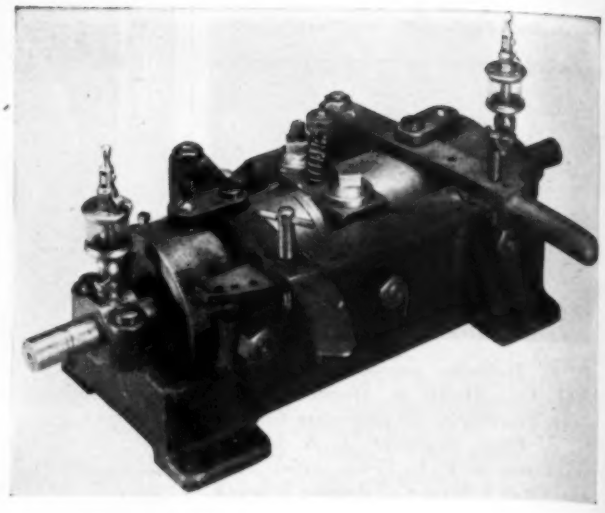

FIG. 1. THE ORIGINAL model of the high pressure oil hydraulic transmission. Completed in 1903, the unit failed to win interest at contemporary trade shows.

50th Anniversary of Oil Power Hydraulics

IN 1903 the first self-contained, high pressure oil hydraulic transmission was completed by Harvey D. Williams, an engineer in the Bureau of Ordnance. Although exhibited in a number of trade shows that year the device attracted practically no attention.

Williams, while an instructor in machine design at Cornell University, had known H. D. Hoadley. Not very long aftter his graduation Hoadley set up a modest plant, the Waterbury Tool Company, in 1898 to manufacture ratchet drills conceived by Williams.

At the turn of the century the automobile was in its infancy. Many engineers were investigating the possibility of developing a hydraulic transmission for the new "iron monster". In 1901 Williams interested Hoadley in the manufacture of his hydraulic transmission. Work on a model was begun in March of that year and by 1903 a successful, if noisy, unit was completed. In spite of the lack of interest in the transmission, this unit inaugurated the new era of power oil hydraulics.

Logically, Williams turned to the Navy for possible applications of his transmission. He learned that a new or improved method of operating and controlling the big gun turrets of battleships was being sought. A more accurate and dependable control with a greater range of speeds was imperative. Considerable difficulty had been experienced in keeping the intricate and complicated electrical control system in service.

Work was begun in September, 1904 on two hydraulic transmissions specially designed for gun turrets. Reynold Janney, a Waterbury engineer, did most of the development work. Under his direct supervision, the work on the transmissions was pushed

FIG. 2. A PAPER MILL drive, incorporating the hydraulic transmission, was first installed in 1924. The unit shown dates from 1928. Over 200 similar installations were made.

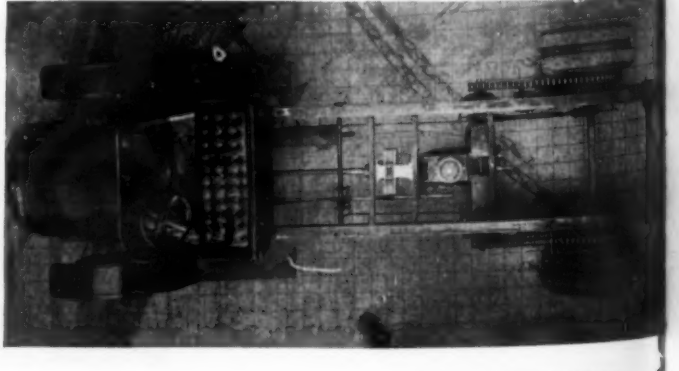

FIG. 3. A BIRD'S-EYE VIEW of a pioneer installation of the transmission in a White truck in 1915. The pump and two hydraulic motors gave satisfactory service for several years.

THE PLACE: RANGERS DIE CASTING COMPANY, Lynwood, California

THE STORY:

Soaked in PYDRAUL . . . Not in Flames

Die-cast products of several kinds are made on the 8 machines in this shop. Two weeks after switching from conventional hydraulic fluid to Monsanto *Pydraul*—and unknown to the operator of a cold-chamber aluminum die-casting machine—an electrical circuit failed.

Operator continued to run the machine until the nitrogen in the accumulator unloaded into the oil reservoir, blowing *Pydraul*, which is fire-resistant, twenty feet into the air—all over the machine, operator, helper, and directly into an open pot of molten aluminum.

THE POINT OF THE STORY:

"Instead of a flash fire and serious burns to several workmen, we suffered only to the extent of two fluid-soaked workers and 40 gallons of *Pydraul*." *Paul T. Harlow, President.*

How safe is the fluid in *your* hydraulic lines today? Without any alterations in equipment, the change-over to *Pydraul* can be made.

PYDRAUL is fire-resistant . . . noncorrosive . . . chemically stable . . . nonreactive . . . nonvolatile—does not evaporate.

SEND for this engineering report. Ask for "Pydraul F-9." Write Monsanto Chemical Company, Organic Chemicals Division, 800 North Twelfth Blvd., St. Louis 1, Missouri.

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TAYLOR-
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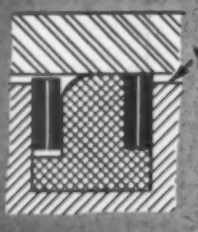
Picked for

"PRESSURE-PLUS"

In Taylor-Wilson's Automatic Hydraulic Pipe Testing Machine, the main packing problem was that of pressure. Non-extrusion at 3000 psi-water was the requirement. The G-T Ring was used successfully in a Youngstown Sheet & Tube Co. installation and in a pipe-tester later installed for the National Tube Co., a division of U. S. Steel Corporation. It has been "under pressure" for Taylor-Wilson ever since!

CANNOT EXTRUDE, *because*



As pressure is applied, conventional packings soon extrude into clearance space Y, then fail. Not so the G-T Ring! Because of its design consisting of a resilient sealing ring in a T-Section supported on each side by two non-extrusion rings, it cannot extrude. As pressure is applied to the G-T Ring, the resilient material flows under the non-extrusion rings, urging them against the cylinder wall and blocking the path of extrusion.

In pressure applications, dynamic or static—pick Palmetto G-T Ring—the packing designed expressly for non-extrusion.

Our 90th Year — Nearly a Century of Quality

Write for literature on Palmetto Molded Packings for more information on G-T Ring and other specialized molded packings.

PALMETTO Packings

packing more performance into every application

GREENE, TWEED & CO. North Wales, Pa.

Oil Hydraulics Anniversary

along as rapidly as possible in the plant of the New Britain Machine Company at New Britain, Conn.

After shop and laboratory tests, one of the transmissions was taken to Washington and further tested at the Navy Yard and at Indian Head. As a result of the success of the Service tests, an order was placed for a transmission to be installed on the U.S.S. VIRGINIA to elevate the primary batteries of 12 inch guns. This installation, completed in June 1906, marked the first successful application of oil power hydraulics.

The first installation was so advantageous that by 1908 about a hundred such installations were made.

FIG. 4. THIS 37 wire planetary type stranding machine built by Wire Machinery Corporation of America used the hydraulic variable speed transmission to drive the capstan and replace change gears formerly required for varying the lay of the wires.

The Williams-Janney hydraulic variable speed gear, as the transmission came to be called, became standard equipment for elevating gun turrets, not only in the U. S. Navy, but in all the fleets of the world.

The Williams-Janney hydraulic variable speed gear consisted of a nine plunger variable stroke pump and a fixed stroke or constant displacement hydraulic motor. The two units could be placed in the same housing in parallel or at any angle or they could be installed as separate units adjacent or at some distance from each other. From this basic power unit almost all modern oil hydraulic high pressure piston pumps and motors have been evolved.

Shortly after the first turret applications, the transmission was adopted for hoisting ammunition from the magazines to the guns. In 1916, a contract was placed with Waterbury Tool to design and build a hydraulic steering gear pump for the U.S.S. NEW MEXICO, the largest and fastest battleship of its time. The success of this type of steering gear duplicated that of the transmission for elevating guns and soon became standard for all surface and undersea naval craft. This type of electro-hydraulic steering gear, constantly improved, is still in use by most naval and merchant marine vessels and passenger liners.

During the period 1906-1919 almost all the facilities of Waterbury Tool were taken up with the development of hydraulic drives for the Navy Department. However, a number of industrial applications were made during this period. In 1914, a transmission was sold to the American Brass Company at Kenosha, Wisconsin, for use on a drawbench. In 1915, a trans-

mission, consisting of one pump and two hydraulic motors, was installed on a White truck. The truck gave satisfactory service for several years. In 1919, a drive for a rubber calender was furnished to the St. Louis branch of the U. S. Rubber Company.

Commercial applications were also made during this period by other hydraulic suppliers like Manly Drive Company and American Engineering Company. Charles Manly, chief engineer of the Manly Company, developed a hydraulic transmission which found both automotive and marine applications. Manly is best remembered as the designer and builder of the first radial aircraft engine while serving as assistant to Samuel P. Langley during flight tests of the latter's famous Aerodrome. The American Engineering Company installed many Hele-Shaw pumps on ships, particularly in steering gear applications. This company also made a number of large industrial applications. With two other hydraulic pump builders, the Oilgear Company and Vickers, Inc., who came into the field in the early 1920's, the roster of early manufacturers was practically complete.

The Disarmament Conference of 1921, which practically scrapped the Navy building program, left the

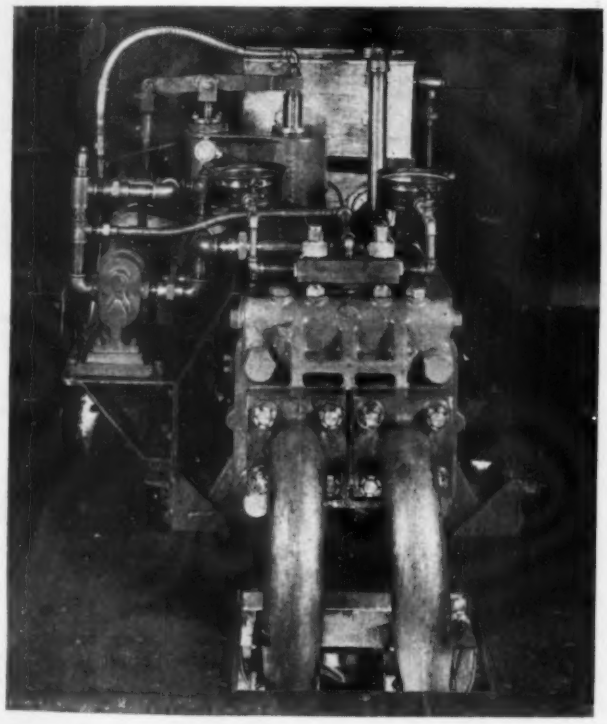
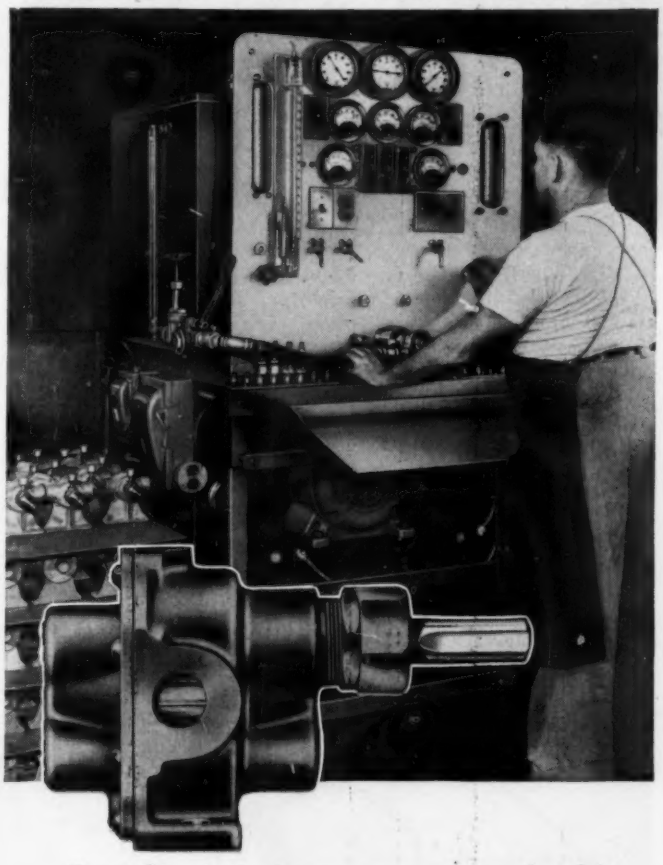


FIG. 5. THE GAS ENGINE and hydraulic pump in the first hydraulically driven railway car in the United States. The two hydraulic motors are below the floor. This car was put in service on the Waterbury-Bristol run of the New York, New Haven and Hartford R. R. Co. in 1923.

Waterbury Tool Company practically without a market. In the industrial field, which was then intensively cultivated, particular interest was developed in the paper mill equipment field. Hundreds of transmissions were sold to paper mills, the first in 1924. Many of these original installations are still in service. Among standard machine tools, applications were made on large milling machines and on broaches. Billet goug-

The X,Y,B,M of OBERDORFER'S NEW BRONZE PUMP PRODUCTION



Every Oberdorfer bronze pump now produced is tested by one of the performance measuring devices designed in our laboratories and illustrated above.

This machine very accurately and rapidly discloses any variations from our high standards of volumetric efficiency at several speeds and pressures, as well as inches of vacuum, power consumption, foundry quality and the degree of precision of machined parts and assembly operations.

Only after each pump has satisfactorily complied with all of our standards is the inspector allowed to stamp (on the right port of *each* pump) his identification, which might be X, Y, B or M.

This procedure has made possible a uniform high quality production unavailable here before.

The new Oberdorfer pumps are stocked by the leading Industrial Distributors everywhere. Write us for the one nearest you.

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Oil Hydraulics Anniversary

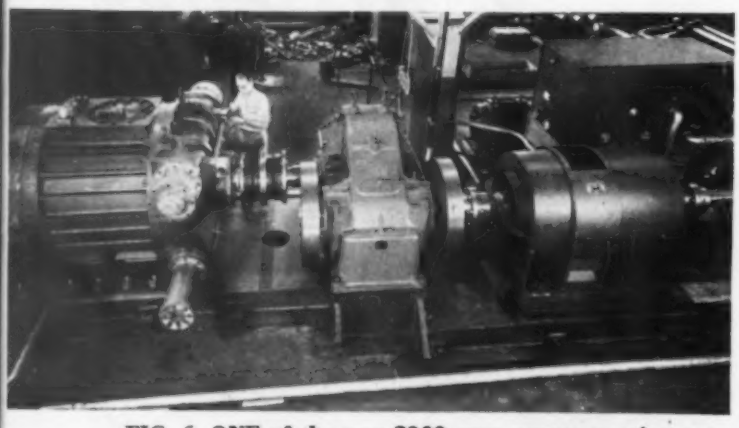

FIG. 6. ONE of the new 2300 gpm pumps nearing completion in the Waterbury shops. Two of these pumps will operate the drive system for an 18 inch tube reducing mill.

ers, built with Waterbury transmissions, were installed by many of the major steel mills. Applications were also made on cable and stranding machines, copper casting wheels and special machines of many types.

An interesting pioneer application of the transmission was on a railway car. This installation, the first hydraulically driven railway car in the United States, was put into service in 1923 on the Waterbury-Bristol run of the New York, New Haven and Hartford Railroad Co. A 150 hp gas engine drove the pump and two hydraulic motors.

During the early 1930's, with the acceleration of the Navy's building program, many new types of vessels with more exacting power requirements spurred the development of hydraulic units and controls of improved design. For example, the primary 16 inch batteries of our new battleships are mounted in turrets which weigh over 1800 tons or as much as a modern destroyer.

In the post-war period, two applications are of special interest. The S. S. UNITED STATES, the largest and fastest liner ever built in America, was equipped with Waterbury steering gear pumps. These pumps are the largest oil hydraulic pumps ever built for marine service. Just recently, Waterbury completed and tested the largest variable displacement, reversing oil hydraulic pumps ever built. Each pump delivers 2300 gpm and transmits 4000 hp at 3000 psi. Two of these giant pumps will operate the drive system for an 18 inch tube reducing mill. This machine—now being built by E. W. Bliss Company for a new Bureau of Aeronautics facility which will be operated by Tube Reducing Company of Wallington, N. J.—is the largest machine of its type ever built. The magnitude of this machine may be realized when it is recalled that the largest reducing machine to date uses an ingoing tube of only 6-½ inches OD.

While the oil hydraulic industry is 50 years old, the accelerated growth of the industry since the close of World War II is clear evidence that far greater opportunities for design developments and application achievements lie ahead.

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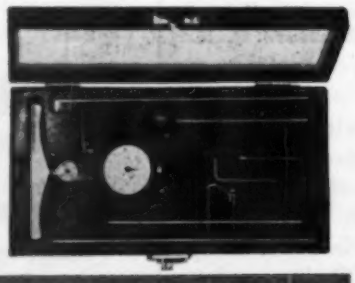

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Hydraulic Control Systems Are Designed for Safety

By
Chalmers A. Strayer
and
Wilfred F. Talbot

IN the measurement of the success of any new device or system when applied to aircraft, fifty years of aviation has shaped its own qualifying yardstick—is it safe? Is it reliable? Northrop Aircraft, Inc., in its experience with powered controls, has an unusual report. With seven years of flying on six different types of airplanes built for the U. S. Air Force, not one accident was attributable to the full power control system. This record speaks for the reliability of such a system. In the present high-speed airplanes, this system is finding wide favor as it provides the solutions to a complex control problem.

Hydraulic power in flight control systems was first introduced in the form of a "boost system" that magnifies the pilot's effort by means of a hydraulic system. In this system, both magnitude and direction of the surface load is transmitted to the pilot. The mechanism which permitted this ratio had an inherent characteristic of permitting a "dead band" region in the control system. This meant that to reverse the control surface, the controls passed through a region where the hydraulic system was ineffective.

Full Power Control Needed

In the design phase of Northrop's B-35 Flying Wing, it was desirable that the controls should transmit zero load back to the pilot and that any "dead band" region should be eliminated. This was due to the floating angle position of the elevon control surface of the airplane. During the landing phase, as the angle of attack on the wing was increased, the floating angle of the elevon control surface also was increasing until a hinge moment reversal on the elevon was necessary to prevent a stall. This was felt to be a very unnatural force condition for a pilot to maintain. If the elevon forces were transmitted back to the control column during landing, the pilot would find that as the wing angle of attack was increased, the pull force required on the stick would decrease rather than increase, until it became a pushing force.

CHALMERS A. STRAYER, Hydraulic Designer and W. F. TALBOT, Supervisor, Hydraulics and Pneumatics, Northrop Aircraft, Inc.

Full powered control system is simpler and lighter than a "boost" system, eliminates a "dead band" region and responds to normal control movements of the pilot.

Furthermore when the elevon passed through its hinge moment reversal region, it was desirable not to have a "dead band" region in the control system unsupported by hydraulic power. It was then that the "full power" control system was born.

To T. A. Feeney and W. L. Parker, associated with Northrop during the B-35 development stage, goes much of the credit for the development of the full power system. The basic concepts of this system as outlined in 1942 for the B-35 are much the same today.

In full power system, pilot effort moves a servo valve which directs fluid to the surface actuator. As the pilot no longer "feels" the surface loads that aid him in controlling the airplane, an artificial load feel system is installed in the control system. On the B-35 and subsequent Northrop airplanes, springs were used to produce load feel in the yaw and roll axes and a force bellows for the pitch axis. The force bellows combines the use of springs and ram air pressure. Bob weights and "g" limiters may be installed as well. An artificial feel system has an advantage wherein any desirable force characteristics may be incorporated, thus making a large airplane as easy to fly as a small one.

The servo valve and surface actuator, designed so that the surface control is irreversible within the relief valve pressure limits of the hydraulic system, permit a rigid installation thus making it possible to eliminate the counterbalances on the surface. Ground locks also may be eliminated. In addition, because the control cables are used to transmit a signal rather than a high force, design can be light to reduce weight and friction forces as well as to provide very accurate control. Numerous control systems have been designed at Northrop to obtain minimum increments of surface control motion below 0.005 degree. This increment can be maintained from input signals generated at the pilot's control stick.

Other advantages include such items as making the control system serve a secondary function as an autopilot servo, allowing trim through the complete range of surface travel without losing the effective area of the surface such as occurs with a tab control, and providing a lighter and more simplified system than a "boost system."

Four Independent Systems on B-35

The B-35 Flying Wing bomber, for which the first powered control system was designed, was a four-engine version with contra-rotating pusher type propellers. For this airplane "elevons" were designed. These elevons function as either ailerons or elevators, or any combination of the two. In addition to the elevons, split rudders on the wing tip trailing edges and the leading edge slot doors were actuated by the powered system. A dual system was used, that is, two actuating cylinders acting in parallel on each surface,

NORTHROP Flying Wing YB-49, largest, longest-ranging jet airplane has hydraulically powered flight control system. Each of the eight jet engines drives a variable volume pump; adjacent pumps are interconnected so that loss of one engine reduces hydraulic power on each surface on each side by only one-fourth. The eight engines are capable of producing a combined, sustained 32,000 hp.

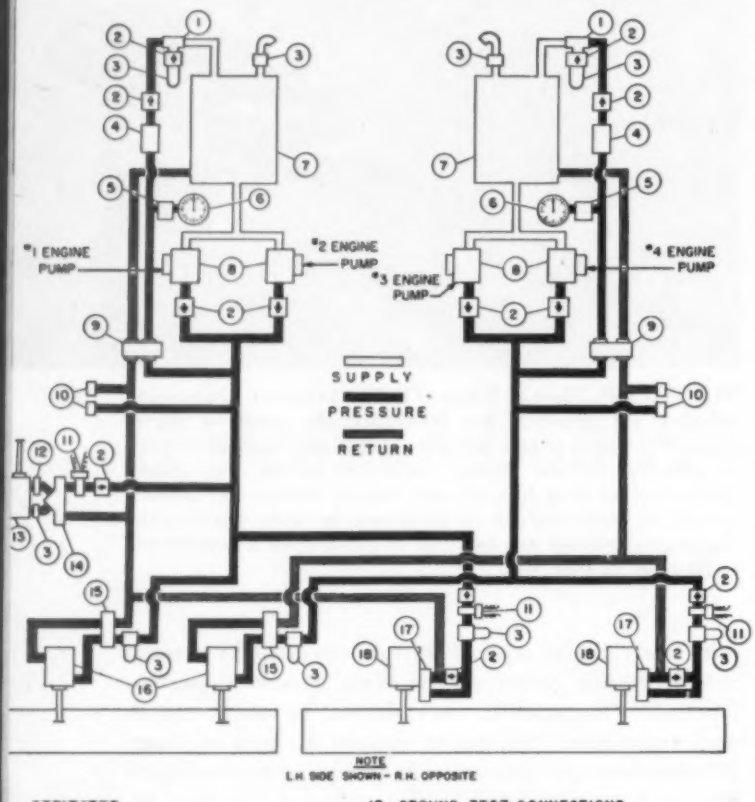
with one cylinder on each surface operated by a separate hydraulic power source. Two hydraulic pumps, connected in parallel, were driven by each engine and constituted the power source of each of four complete separate systems. The pumps on the outboard engines were connected to the outboard cylinders on each surface and those on the inboard engines were connected to the inboard cylinders. Thus, there were four independent systems, each serving one-half of each surface control. As a safety measure in case of the loss of two engines on one side, the inboard systems were connected by cross transfer lines, as were the two outboard systems. Normally closed solenoid-operated valves separated the systems. If the pressure of one system dropped below a predetermined value, a pressure switch energized the valves permitting flow from the other system. A solenoid valve in the return line directed the flow to the proper reservoir.

The leading edge slot doors, spring-loaded to the open position, could be actuated in either direction by four-way solenoid valves controlled by aerodynamic switches which responded to the lift of the wings.

The success of the system was credited largely to the development of a full-scale laboratory control system mock-up. The first tests showed an unacceptable chatter which had to be eliminated. Factors which could contribute to chatter and instability were (1) percentage of occluded and entrained air in the oil, (2) compressibility of fluid, (3) pressure, (4) structural supports of actuator and surface, (5) moment of inertia and spring rate of surface, (6) spring rate of hydraulic lines, (7) friction and backlash in follow-up

system, and (8) characteristics of the servo valve.

Since air in the system increases the spring rate of the oil, it must be minimized. Air in the oil can be reduced with a reservoir designed so that air can be separated from the oil and the foaming tendency reduced. To prevent entrained air from entering the system, the pump suction line in the reservoir must be submerged in oil under every flight condition. Another approach is to use an airless type of reservoir, preferably of the type which can purge itself of air.



1. ASPIRATOR
2. CHECK VALVE
4. FILTER
5. RESTRICTOR & FILTER
6. GAGE LINE FUSE
8. PRESSURE GAGE
9. RESERVOIR
10. PUMPS, VARIABLE VOLUME
11. RELIEF VALVE
10. GROUND TEST CONNECTIONS
11. SOLENOID VALVE
12. RESTRICTOR
13. SLOT DOOR CYLINDER
14. VALVE
15. RUDDER SERVO VALVE
16. RUDDER CYLINDER
17. ELEVON SERVO VALVE
18. ELEVON CYLINDER

DIAGRAM of one side of the hydraulic power system for the YB-49. Pairs of pumps are interconnected to form two separate systems or four systems for both sides.

The spring rate of the oil is also dependent upon the system pressure. For use in aircraft, the spring rate may be considered relatively constant above 700 psi. Pressure normally is metered to only one side of an actuator at any single instant. In a full power control system it is important to meter a pressure of at least 700 psi to both sides of the actuator as a preload to increase oil stiffness when no external loads are being applied. This charactertistic aids in preventing chatter as well as aerodynamic flutter and can be accomplished through neutral leakage in the servo valve.

System flexibility in the local region of the actuator must be closely controlled so that its effects are minimized. Low spring rates in the actuator support, surface support, and the surface itself create a tendency to chatter. Where it is difficulty to minimize the structural deflections to stabilize a system, it may be necessary, and is considered good design, to transmit the deflections to the servo valve input signal to compensate for an undesirable gain from the hydraulic system.

Lines between the servo valve and the actuator are undesirable. If lines are necessary, they should be kept short and be of a rigid type. Flexible hoses must be avoided. Northrop has avoided trouble by mounting the servo valve on the actuator. Additional advantages are readily seen from this arrangement. An excellent follow-up system is provided which has no backlash or friction problems, and the surface has an additional protection from line failure.

The characteristics of the servo valve play the largest role in producing instability. If the valve has too high a gain, excessive friction, dynamical forces, backlash, or a "dead band" region, instability can result. The first valves procured for the B-35 had some of these poor characteristics. Recognizing the problems involved, Northrop ventured into the development of a servo valve which would satisfy these requirements and still incorporate a high degree of reliability.

Custom Designed Servo Valve

A servo valve must be tailored to the individual control requirement. Manually controlled full power systems permit mode latitude in system design because the gain in the servo valve may be kept low. Simple gain reduction devices may be incorporated to reduce the gain and make the valve less critical from a design and manufacturing standpoint. When an autopilot function is incorporated into the servo valve, the response of the system is more critical, thus requiring the servo valve and the entire installation to be designed to more stringent requirements. A still further advancement of the full-powered system was forthcoming in the YB-49, the eight-jet version of the Flying Wing. One hydraulic pump was mounted on each engine and adjacent engine-driven pumps were interconnected to form the power source for each system. With eight engines, each driving a pump, system vulnerability was greatly reduced. Loss of one engine reduced the hydraulic power on each surface on one side by only one-fourth. A new phenomenon occurred, that of windmilling of the engines. If one engine became inoperative but did not seize, windmilling of the engine would continue to produce a reduced flow of hydraulic power. For this reason the cross transfer lines were eliminated. Thus, the YB-49 had four completely independent surface control systems.

The Flying Wing, however, proved to have an unusually low drag and the engines were throttled back on landing more than had been anticipated. This produced an effect which was later analyzed as "interaction." When the pilot operated the elevons as elevators, and suddenly opened the rudder on one

side of the airplane, he would feel lateral tug on the control stick. The cause of this tug was that the opening of the rudder required most of the flow from the systems on the respective side, with the result that the motion of the elevon on that side was slowed up. The elevon surface on the opposite side had plenty of flow, and continued to react at the normal rate. This resulted in an "aileron action." To correct this interaction phenomenon, restrictors were added in the rudder cylinder lines to slow down the rate of motion. This arrangement permitted the pumps to supply

TWO completely independent hydraulic systems are incorporated in the USAF F-89D Scorpion. One system is for surface controls; the other for controls and other utility systems. Either system acts as an emergency system for the other without pilot action.

sufficient flow and pressure for proper operation of the surface controls at low engine rpm.

The reliability of the multiple hydraulic system was demonstrated on a flight of a YB-49 from the East to Los Angeles in which four engines—three on one side, one on the other—were shut down because of roughness. Despite the asymmetrical power configuration resulting, no difficulty was experienced in controlling the airplane in flight or upon landing. The windmilling jets provided valuable assistance.

The U. S. Air Force F-89D Scorpion, America's most heavily armed fighter-interceptor incorporates a simplified and lighter dual hydraulic powered system. Two completely independent hydraulic systems are used, one for the surface controls only, the other for the controls and for other utility systems. The control actuators in each system provide one-half the hinge moment required and are in operation at all times. With both systems operating, either can serve as an emergency system without any pilot action and without the need of emergency devices. Operating on one system the airplane remains highly controllable and can accomplish all but the very severe maneuvers.

The powered control systems which are successfully being used in today's modern airplanes are in a great measure due to the exhaustive design, laboratory, and flight testing at Northrop during the past decade. Though the trend is toward simplicity, today's designs involve many complex mathematical formulas. Research and development programs are continuously in progress to provide responsive, simple, and safe systems for the control and guidance of our country's present and future airborne equipment.

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THIS MONTH'S MOTOR TIPS

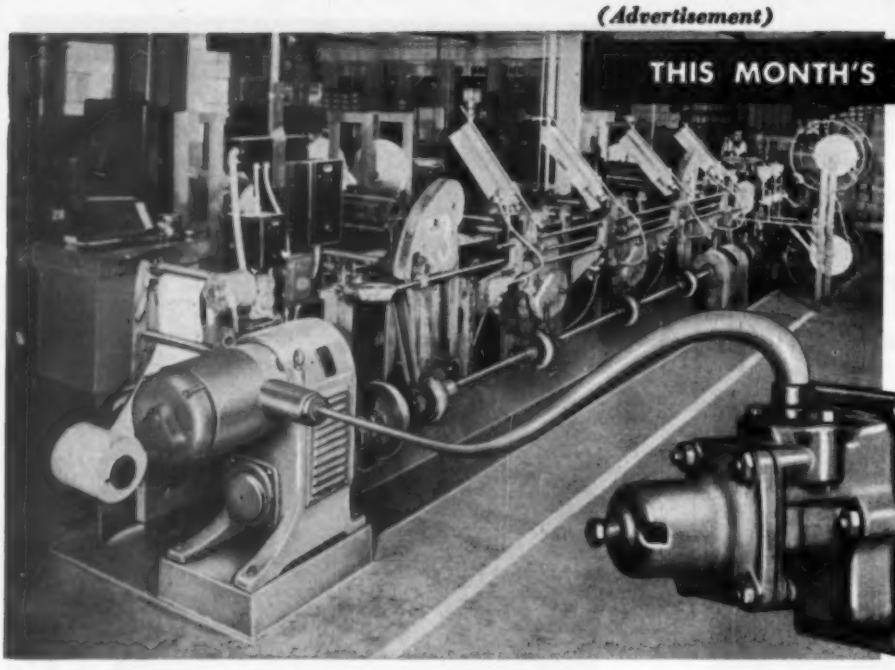


FIG. 1—Pneumatic control for Varidrive motor, permits quick speed changes from any remote control station. Photo shows Varidrive operating film processing equipment.

REMOTE CONTROLS AND SPECIAL HOOK-UPS OF VARIDRIVES GAIN POPULARITY

NEW DEVELOPMENTS in *VARIABLE SPEED* MOTOR DRIVES

RECENT innovations in variable speed drives include new and improved types of remote control equipment. Beyond the purely functional duty of a variable speed motor, such as a Varidrive, the latest methods of controlling it open up new adaptions to machines and equipment.

Motors cannot always be placed in a location convenient to the operator. In the case of fixed-speed motors this doesn't matter much because the operator has only to push a button to stop or start it, even if the motor is in the secluded center of a maze of machinery. But now, the manufacturers of the U. S. Varidrive motors have developed a complete line of remote controls to start, stop and regulate speeds sensitively set to a split rpm. Consequently a Varidrive motor can now be set in any location best positioned for the most compact and efficient hook-up and the operator can control it a mile away if necessary.

MECHANICAL AND ELECTRICAL

Remote controls of Varidrives may be basically divided into two classes, mechanical and electrical. The mechanical arrangements permit the use of extensions of the control dials straight out or universally positioned. For example, a Varidrive high up out of reach can be controlled from the floor by a simple extension supplied by the manufacturer. An excellent feature of the Varidrive control dial is that it is always located at the operator's station where he can dial from the slowest to the highest speed and read the calibrations of speed during dialing.

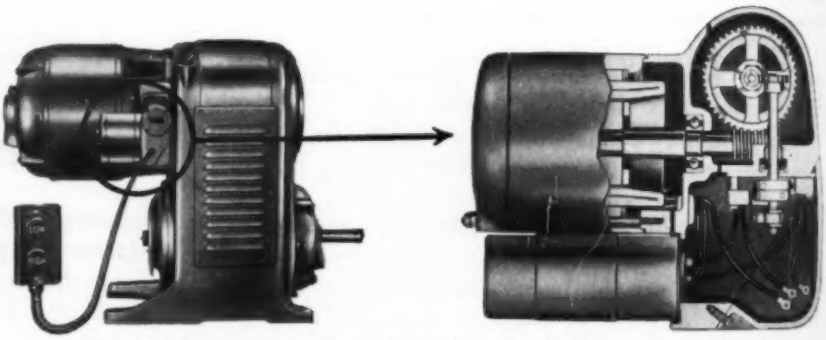


FIG. 2—ERC control motor changes speeds on Varidrive with push-button control.

For electrical controls, numerous arrangements have been perfected, of which one of the most popular is the Varidrive's Type ERC heavy-duty control motor. (Fig. 2.) Intead of the dial, this motor, which is 1/15 h.p., 1800 rpm, is attached to the control mechanism. It is a ruggedly designed auxiliary motor of the reversible capacitor type and has a low inertia rotor for quick stop, with push button control. Its rugged worm drive actuates the Varidrive's speed control and it has adjustable limit switches.

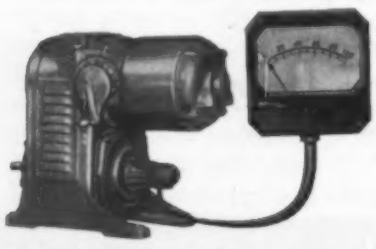


FIG. 3—Speed indicator tells Varidrive rpm at any distance. Can operate with push button if preferred.

SPEED INDICATOR

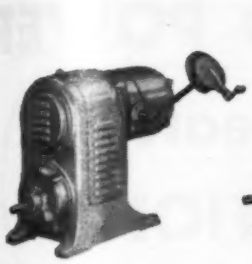
For electrically determining the speed of a U. S. Varidrive, a Type R1 speed indicator can be provided. (Fig. 3.) It consists of an enclosed tachometer with a generator mounted on and driven by the Varidrive. Speeds are indicated as per cent of maximum speed.

QUICK STOP CONTROLS

For machines requiring fast braking of Varidrive motors, the ICB brake is used. (Fig. 4.) It is mounted directly upon the Varidrive's take-off shaft, eliminating transmission of braking action through the belt. Such a device is ideal for "inching" or jogging. Its functional force is controlled by magnetic action.

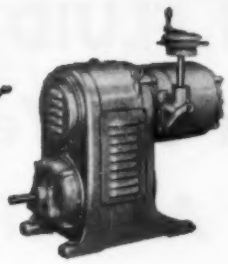
The Warner automatic clutch is also used on many Varidrives, particularly on heavy presses for gradual pick-up to overcome heavy inertia. To properly adopt this improvement, the manufacturers of Varidrives provide special engineering service.

TYPES OF MANUAL REMOTE AND ON-MOTOR CONTROLS FOR VARIDRIVES



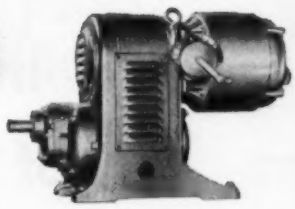
UNIVERSAL COUPLING

FIG. 6—For operating Varidrive at any angle to 30°. Rod any length.



RIGHT ANGLE DRIVE

FIG. 7—Control dial set at any of four 90° positions at right angle to standard setting.

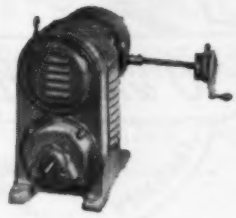


ON-MOTOR CONTROL

FIG. 8—Not remote control, but showing location of control dial on motor.

CHAIN & SPROCKET

FIG. 9—Sprocket connected to rod by chain drive with two bearing supports.



DIRECT EXTENSION

FIG. 10—Rod connects Varidrive through sleeve coupling to project any length.

PNEUMATIC CONTROLS

When frequent motor speed changes are necessary, a pneumatic control is preferable. (Fig. 1.) Such a control as used in Varidrives includes a positioning unit embodying an air-operated plunger attached to the motor's speed changing device and a pressure regulator. Many methods may be used to operate the regulator such as pedal, lever, cam or wheel. By use of check valves and control station selectors, speed of the Varidrive can be changed from any number of control stations, or several Varidrives can be operated from one control. This device will operate on the customer's air supply of 60 or 100 psi or more.

FIG. 4—Brake control instantly stops Varidrive. Excellent for "inching" motor.

AUTOMATIC SPEED REGULATION

In case a motor user operates such mechanisms as follower rolls and air cylinders which permit movement proportional to the desired speed range and can be mechanically linked, a compact lever actuator can be attached to a Varidrive motor. (Fig. 5.) Maximum/minimum speeds may be pre-set by means of adjustable speed stops located on the exterior.

DIRECTIONAL MANUAL CONTROLS

In what position a Varidrive is set in relation to the driven machine and operator's position of accessibility depends the location of the manual control dial. The case of the Varidrive is so designed that the control dial can be placed on the front side, back or top, and the take-off shaft positioned to right or left, high or low. This feature is of special interest to the design engineer who wants the most compact setting with greatest convenience to the operator.

OTHER VARIDRIVE INNOVATIONS

A notable improvement in Varidrives is the use of a double-ribbed varibelt which not only allows maximum flexing but permits use of smaller disc diameters. Greater horsepower can be developed within a smaller space. This newest of belt features reduces internal friction and provides greatest flexibility without sacrifice of strength. Dual varibelts, double-ribbed, are also available for high horsepower. For extra heavy duty, dual varibelts are provided for 25, 30, 40 and 50 horsepower.

FIG. 5—Automatic speed regulation to pre-set limits on Varidrive by lever control.

Of interest to those seeking a variable speed motor in fractional horsepower is the new VA Varidrive. It is an all-in-one power package in ¼, ⅓, ½ and ¾ horsepower ratings in one or 3-phase.

Those who have used Varidrive motors quickly recognize the improved output that can be obtained in almost any machine. Variable speed has become such an important factor in the mind of the aggressive design engineer that he has found it feasible to redesign equipment to take full advantage of variable speed potentials. With the availability of any desired Varidrive control system he finds new fields of application not heretofore possible.

A number of interesting engineering booklets have been written and profusely illustrated by the makers of U. S. Varidrive motors dealing with remote controls and variable speed applications. Copies may be obtained from U. S. Electrical Motors Inc., Box 2058, Los Angeles 54, California, or Milford, Connecticut.

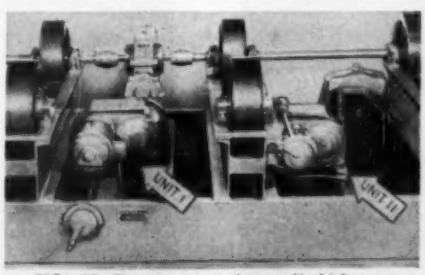


FIG. 11—Remote controls on Varidrives operating automatic welding machine.

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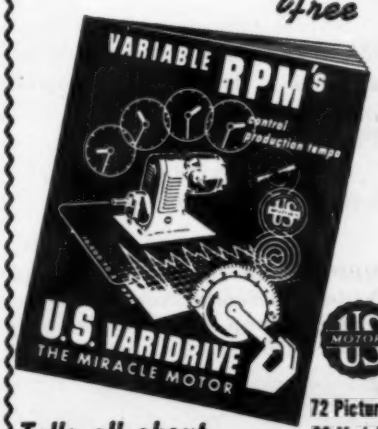

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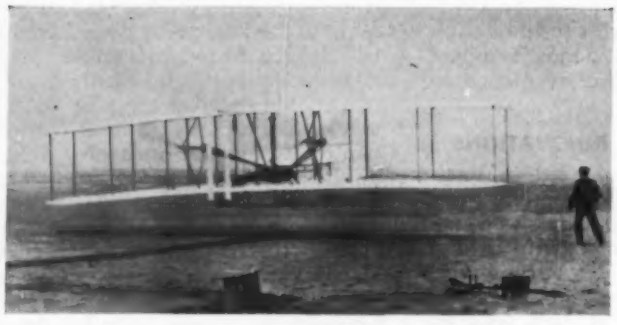


PERHAPS the most famous of all flight pictures shows Wilbur Wright running along side and Orville Wright lying prone to the left of the motor on the first powered flight in history.

WHEN the Wright Brothers went to Kitty Hawk, North Carolina late in September, 1903, they were confident that their plane, fitted with the motor built the previous year, would fly. Steady progress had been made through a series of glider flights, 1900-1902.

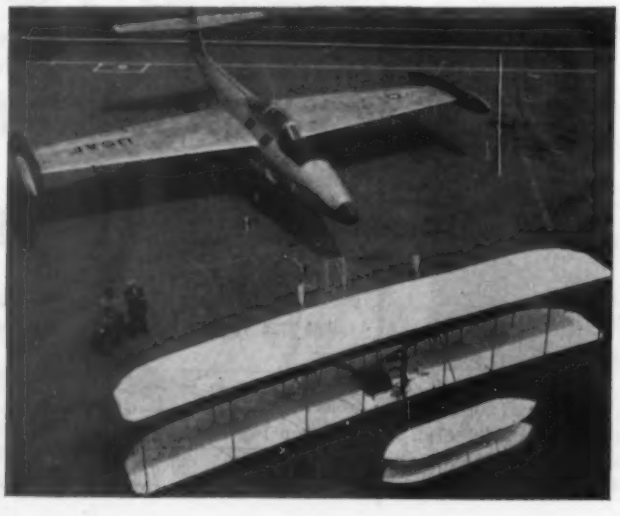
Several mishaps delayed the first attempt. During this time Langley and Manly made two unsuccessful attempts to fly the Langley aerodrome from a launching platform on the roof of a houseboat in the Potomac river.

Conditions were considered favorable on the morning of the 17th of December. At 10:35 all was in readiness. Orville Wright won the toss for the first flight. The plane ran down its launching track and became airborne. The flight covered about 120 feet in 12 seconds. Wilbur on the fourth and last trip flew 852 feet in 59 seconds. Man had conquered the age-old problem of flight.

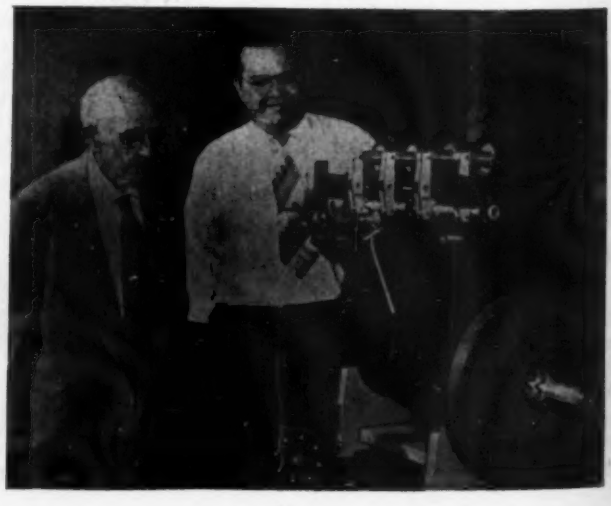
An interesting sidelight, in view of present plane costs, is that the first machine flown in 1903, cost less than one thousand dollars, including the travelling expenses of the Wrights between Dayton and Kitty Hawk.

The Wrights offered their invention to the government in 1905, but it was not until August, 1909 that

REPLICA of the first Wright plane exhibited at the National Aircraft Show in Dayton. It is shown in front of a Northrop F-89 Scorpion all-weather interceptor to illustrate 50 years of progress.



CHARLES E. TAYLOR, left, foreman of the Wright bicycle shop where the original motor was built is shown with Roy E. Marquardt, president, Marquardt Aircraft Co., whose employees built the replica engine.



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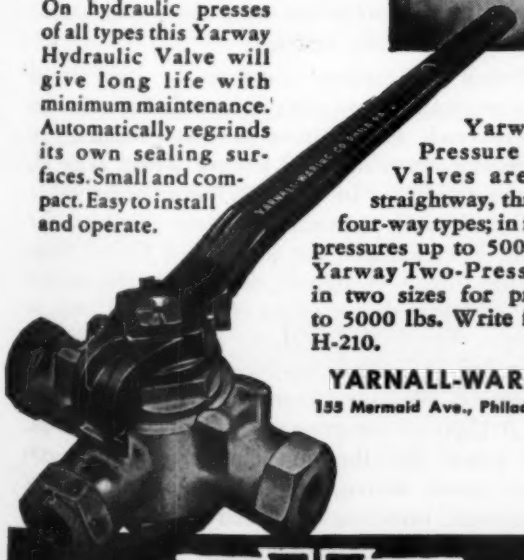

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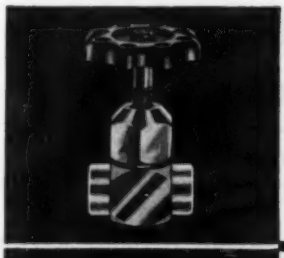

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- Use for shut-off or metering
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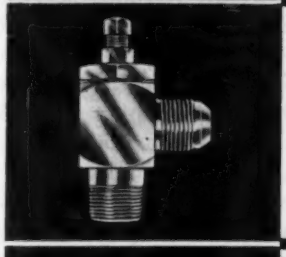

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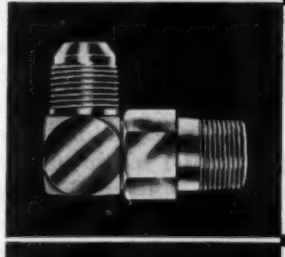

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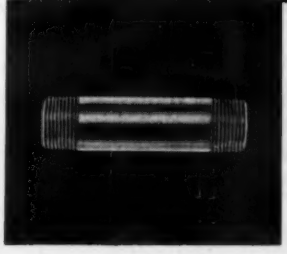

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the Signal Corps accepted a Wright plane. Others entered the field. Glenn Martin built his first plane in 1905; Glenn Curtiss, built and flew his first plane in 1908. In 1911 Calbraith Perry Rodgers made the first transcontinental flight from Long Island to California in 49 days and 68 hops.

The Wrights and Curtiss trained exhibition teams that barnstormed, staging flying circuses at county fairs, carnivals and amusement parks. The "air men" flew by "the-seats-of-their-pants" manually controlling everything.

The outbreak of the war in 1914 stimulated the development of aircraft. Attack aviation, in the form of individual combat or "dog fights", reconnaisance, artillery fire observation and photographic missions came into being. By the end of the war the role of military aircraft was established. General William Mitchell devised and commanded the first mass air campaign in history during the great Saint Mihiel offensive in September, 1918.

Postwar, as flying and landing speeds crept up, plane builders provided pilots with hydraulic wheel brakes, manually controlled. Such brakes reduced the roll on landing and were useful for hangar parking. These brakes, while crude and often not too reliable, were a beginning.

Postwar development of aircraft included services for transportation and commerce. The first airmail service between Washington and New York and between Chicago and New York began in 1918. Transcontinental airmail service had its beginning in 1924. The Air Mail Act of 1925 stimulated the establishment of air transport companies.

In 1926 Fokker designed and installed the first hydraulically actuated, retractable landing gear. Wing flap operation by the hydraulic system was next. These developments followed closely the appearance of the first constant displacement piston pumps suitable for aircraft use.

The first air flight over the Atlantic was made in the United States naval seaplane NC-4 in May, 1919. Two stops were made in the Azores on the flight from Newfoundland to Portugal. In 1926 Commander Byrd flew over the North Pole and Roald Amundsen flew over the South Pole.

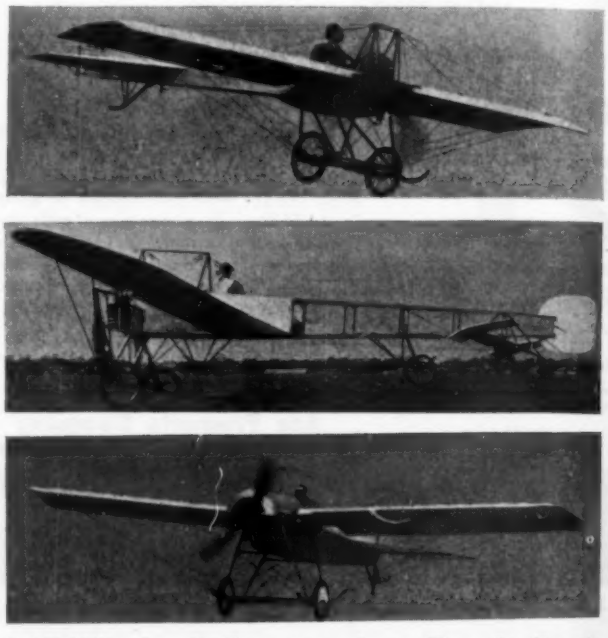
In May 1927 an unknown mail pilot Charles A. Lindbergh made the first solo, non-stop flight across the Atlantic. His flight, from Roosevelt Field to Le Bourget, Paris, gave an immense boost to aviation.

In July, 1936 the modern airliner appeared; a DC-3 made its first run on the Chicago-New York route. The Civil Aeronautics Act of 1938 provided a much more stable base for the airlines.

By 1935 or 1936, years in which the aviation industry was slowly recovering from the depression, military and commercial aircraft were operating wheel brakes, landing gear and wing flaps by an engine driven constant displacement pump in 1000 psi hydraulic systems.

By 1940, when the American aircraft industry began its rapid expansion toward the tremendous production it was to reach (96,318 planes in 1944), several hydraulic services had been added including engine cowl flaps and bomb bay doors. The first application of a pneumatic service made its appearance about this time. The first systems were air bottle operated and they were used to actuate emergency brakes.

For example, the hydraulic system of the B-25 twin engine bomber (1941-1943) operated landing gear, wing flaps, bomb bay doors, engine cowl flaps and wheel brakes, using two engine driven 1000 psi pumps. Air bottles charged to 600 psi were the power source for the emergency brake system.



A GROUP of early European planes. Top, the French Deperdusin, the first plane to fly faster than 100 mph; center, the Bleriot, famous as the first plane to fly the English Channel (July, 1909); bottom, the English Blackburn monoplane.

Cancellation of wartime contracts in 1945 freed many top aeronautical engineering staffs for new design and research. Competition was keen for the few orders. Developments initiated during World War II, which began to appear in 1945-1947 saw considerably more hydraulic and pneumatic services provided for in aircraft. For example, the McDonnell F2H-1 Banshee, a twin turbo-jet fighter, had two independent 1670 psi systems, the constant displacement pumps being driven by electric motors. Hydraulic services were extended to include operation of canopy, nose wheel steering, elevator, aileron and rudder power controls. A 1500 psi compressor, electric motor driven, provided power for the gun chargers and canopy emergency power through an air motor, emergency gear extension, arresting gear retraction and wheel brake boost.

Regular transatlantic passenger service was initiated in 1946 and round the world airline service the next year. In October of this same year test pilot Charles E. Yeager broke through the sonic barrier in the Bell XS-1.

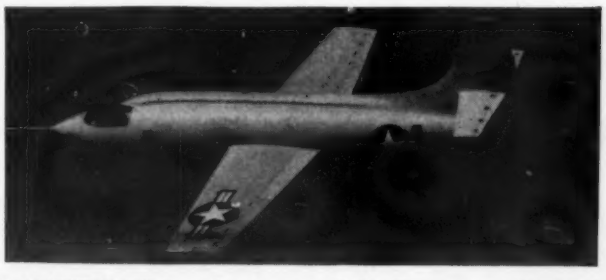
Two examples of the hydraulic systems of fairly

recent military planes will illustrate how important such systems have become.

The North American P-86, single jet pursuit plane originally was furnished with a single constant displacement pump and flow divider to operate the main system and the boost system at 3000 psi. Later models have two variable displacement pumps, one to supply pressure for the main system, the other to supply pressure for normal operation of a dual closed center full power surface control system. An electrically driven pump supplies pressure for alternate operation of this dual surface control system with automatic changeover controlled through pressure switches. Seven hydraulic functions are: landing gear, wing flaps, dive brakes, nose wheel steering, seat adjustment, surface control boost and wheel brakes.

3000 psi Hydraulic Circuit

The B-45 four jet bomber, also a North American airplane, has four hydraulic systems, all 3000 psi systems. Two engine driven constant displacement pumps operate the main system which is depressurized in flight; two engine driven pumps operate the aileron boost system; two electric motor driven pumps operate the elevator and rudder boost; and an electrically driven pump operates the emergency system. Hydraulic power is provided for: landing gear, wing flaps, bomb bay doors, nose wheel steering, emergency crew escape, surface control boost, wheel brakes,



THE BELL XS-1 rocket powered Air Force experimental plane, the first to fly faster than the speed of sound.

Official U. S. Air Force Photo

AMERICA'S fastest transport, the Lockheed Super Constellation. Turbo-compound engines give it a long range cruising speed of more than 340 mph. The Navy model R7V-1 shown, will carry 106 passengers.

emergency wheel brakes, emergency bomb bay doors and emergency wing flaps.

Many aeronautical engineers believe that high pressure pneumatic systems will be more important and render a greater range of services in future aircraft. Both 1500 and 3000 psi compressors, usually engine driven, are in increasing use for emergency and, in some cases, primary operation functions.

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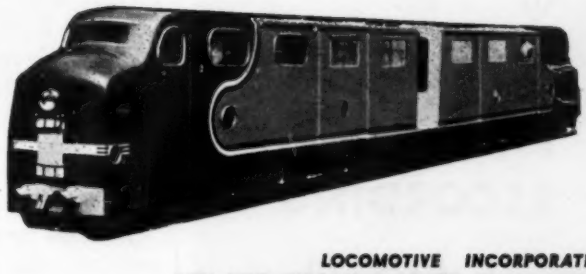

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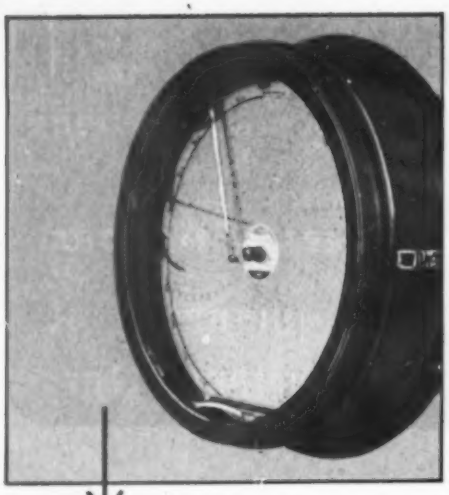

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9th Annual Meeting of the National Conference on Industrial Hydraulics

THE ninth annual meeting of the National Conference on Industrial Hydraulics was held on Thursday and Friday, October 8 and 9 at the Hotel Sheraton, Chicago. More than 600 persons were registered and an additional number attended one or more of the sessions of the meeting. The meetings were outstanding for the caliber and the range of participation in discussions at individual sessions.

Controversy on Presses

Perhaps the most stimulating and certainly the most widely participated in discussion was the Hydraulic Press Session. Chairman Robert G. Tabors, manager, Hydraulic Press and Power Control Department, Baldwin-Lima-Hamilton Corporation, presided over a very informative open discussion after the paper by E. V. Crane and W. R. Jackson of the E. W. Bliss Company and that by A. J. deMatteo of Watson-Stillman Company were given. The panel members Dr. M. D. Stone, manager of development, United Engineering Corp. and E. L. Wefel, vice president, Lombard Corporation, particularly the former, disagreed vigorously with some of the conclusions of the authors. Of particular interest was the news, disclosed to most of the press men who attended for the first time, that very large pumps would be shortly available.

E. L. Carlotta, director, Rubber Research, The Parker Appliance Co.; L. S. Barksdale, president, Barksdale Valves; Fred H. Pollard, assistant project engineer, Republic Aviation Corp.; and Ed. Greer, president, Greer Hydraulics, Inc.

The Industrial Nonflammable Fluids Session, the first to be included in the Conference, heard only one paper, that by James Robinson on "The Effect of Synthetic Fluids on Hydraulic Components and Circuits." Planned this way because of the anticipated interest, chairman J. C. Van Gundy, Technical Research Division, The Texas Company, had a large panel, members of which were active in a question and answer period. Panel members included Dr. W. H. Millett, Carbide and Carbon Chemicals Company; H. Stuart Litzinger, Monsanto Chemical Co.; R. D. Bussard, Lubrication Engineer, Ladish Company; Don P. Morrell, Supervisor Fluids and Electrical Section, Ford Motor Company; and Carl E. Schmitz, vice president in charge of sales, Crane Packing Co. It was apparent that industry is appraising, testing and using nonflammable fluids in an increasing range of hydraulic circuits. Aircraft technical committees have been studying and writing specifications for nonflam-

Edward N. Cunningham, assistant sales manager, Precision Rubber Products Corp.; Dr. William H. Millett, director research, Carbide and Carbon Chemicals Co.; and Norman A. Duffany, Chicago district manager, Precision Rubber Products Corp.

J. R. Hemeon, hydraulic equipment engineer, Ternstedt Division, General Motors Corp.; J. S. Bennett, vice president, American Engineering Co.; and A. J. de Matteo, chief engineer, Watson-Stillman Co.

E. O. Clark, Vickers, Inc.; C. Benjamin Blake and Allan M. Steel, Scovill Mfg. Co.; and J. P. Ivaska, Cincinnati Milling Machine Co.

mable hydraulic fluids for some years and the appearance of this session was very timely. The packing people as well as the components in which hydraulic fluid comes into contact with nonflammable fluids found this session very valuable.

Interest was also high in the automotive, the machine tool, component, aircraft and tractor sessions.

Joseph Geschelin, Detroit Editor, "Automotive Industries" chairmanned the Automotive Session, which heard two papers. Discussion brought out that the automotive industry is testing additional devices for application to motor cars and trucks.

Servo Applications

Vic Blasutta, vice president, engineering, Denison Engineering Co. was chairman of the Machine Tool Session. Papers by D. K. Skoog, supervisor, Servo Mechanisms and Control Systems Section, Armour Research Foundation on "Evaluation of an Hydraulic Control for a Flight Simulator" and by Ransom Tyler, design engineer, Oilgear Company on the "Development of Hydraulic Drive for Continuous Process Industries" were well received and elicited excellent discussion. Panel and open discussion indicated that industry is rapidly accepting servo controls, pioneered by the aircraft industry in many cases, and that hydraulic control is being designed into an even higher percentage of standard machine

APPLIED HYDRAULICS Prize Paper Winners

Irving B. Hexter, publisher, Hydraulics Publishing Co., second from left, presenting the major awards won in the 1953 APPLIED HYDRAULICS Prize Paper Contest. Left to right. C. E. Bowman, University of Illinois, Third Prize of $200.00; Hexter; Clifford Lovenberg, who accepted the First Prize of $500.00 for Frank C. Lornitzo, Pantex Mfg. Corp.; and Charles G. Spicer, Leland Electric, Canada, Ltd., who was co-winner of the Second Prize of $300.00 with his associate Thomas Baxter.

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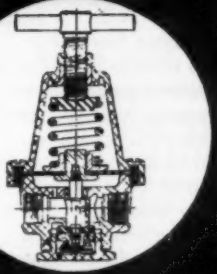

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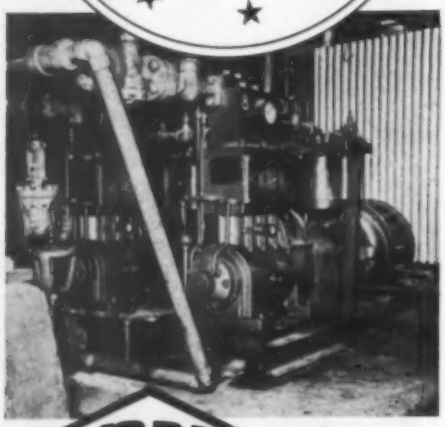

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Lines Seals, Fittings

R. O. Isenbarger, chief engineer, Chicago Rawhide Mfg. Co. was chairman of the Components Session. The papers by J. E. Jass, chief engineer, Caterpillar Tractor Co. "Fluid Carriers for Hydraulic Units in Earth Moving Equipment" and "Factors in Designing for Mechanical Seal Applications to Hydraulic Equipment" by Justus B. Stevens, vice president and chief engineer, and Harold F. Greiner, project engineer, Sealol Corporation. These papers were substantial contributions to the selection, application and care of fittings, tubing, hose and fluid seals.

NCIH Papers

APPLIED HYDRAULICS does not have complete copies of the papers delivered at the Confernce. For information on papers in which you are particularly interested write to Prof. V. L. Streeter, Acting Secretary, NCIH, Illinois Institute of Technology, Chicago 16, Ill. or direct to the author concerned. All technical papers will be published in the Proceedings of the 9th Conference. Copies will be available shortly after the first of the year.

Dr. H. V. Hawkins, director of engineering, Aircraft Division, Globe Corporation, was chairman of the Aircraft Session. John Pelz, Bendix Products Division, Bendix Aircraft Corporation outlined the characteristics, design, operating advantages and applications, both as pump and motor of a high pressure, positive displacement, variable stroke piston fuel pump for aircraft applications. Julius Kendall, vice president, Greer Hydraulics, Inc. did a fine job in reviewing the development of test equipment for aircraft components and systems, pointing out major steps in technological changes and emphasizing the importance of standardized procedures and methods for both military and airline uses. The discussion brought out the fact that test equipment for quality control in high production industrial manufacturing plants is making very rapid strides.

Power Steering

The Tractor Session heard two papers one on a standard family size tractor and the other on a 20 ton crawler tractor. The hydraulic system of the Golden Jubilee Ford Tractor was discussed in a paper given by Harold L. Brock, Tractor Engineering Department, Ford Motor Company. W. W. Henning, Divisional Chief Engineer, International Harvester Co. limited his discussion to a new steering system, "Planet Power Steering" developed for the TD-24, a new 20 ton crawler tractor. L. Pfost, chief engineer, Tractor Division, Massey-Harris Co.

Guy E. Horvath, Raybestos-Manhattan, Inc.; L. W. Shelly, Aldrich Pump Co.; F. J. Kent, Hydropress, Inc.; and Sherman R Doner, Raybestos-Manhattan, Inc.

J. B. Stevens, vice president and chief engineer, Sealol Corp.; D. S. Messenger, Garlock Packing Co.; and H. F. Greiner, project engineer, Sealol Corp.

was chairman of the Tractor Session.

The increasing importance of the hydraulic field is reflected in activities at Illinois Institute of Technology, sponsors with Armour Research Foundations of the NCIH.

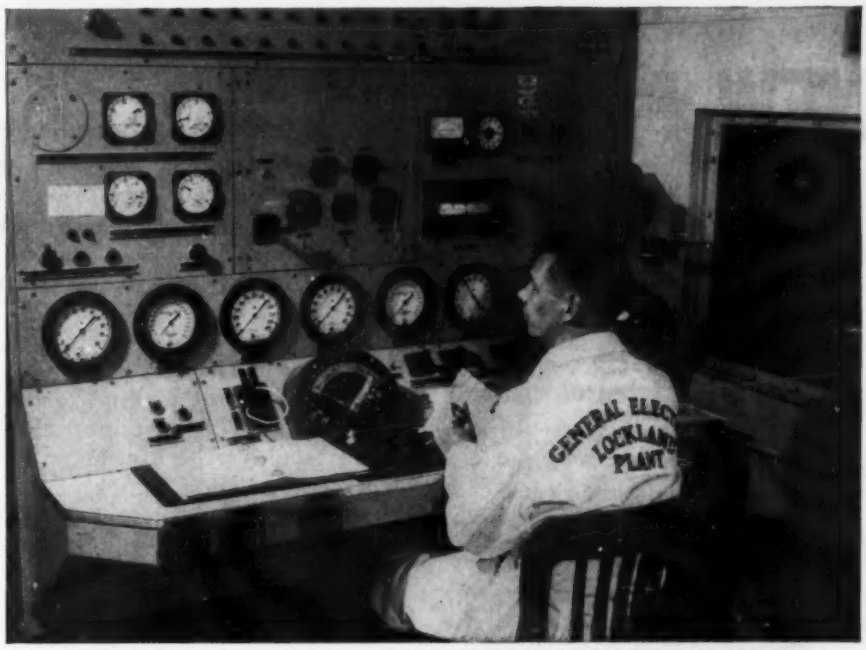
A. J. de Matteo, chief engineer Watson-Stillman Co.; E. Weidmann, chief engineer, The Oilgear Co.; E. S. Keyser, hydraulic engineer and M. J. Grubelich, research engineer, Watson-Stillmann Co.

James T. Greenlee, vice president, Imperial Brass Mfg. Co.; Mildred Doljanin, assistant Conference secretary; Joseph J. Slomer, hydraulic engineer, Goodman Mfg. Co. and former NCIH Director.

This fall a new course, Oil Hydraulics, is being given. A short course in oil hydraulics on the maintenance level is being planned for the summer of 1954. In conjunction with this course, as well as to extend research in oil hydraulic problems, a hydraulic laboratory is in the process of being setup. Another development of interest is that the Executive Committee of the NCIH has determined to add papers and perhaps a separate session on pneumatics to the 1954 Conference.

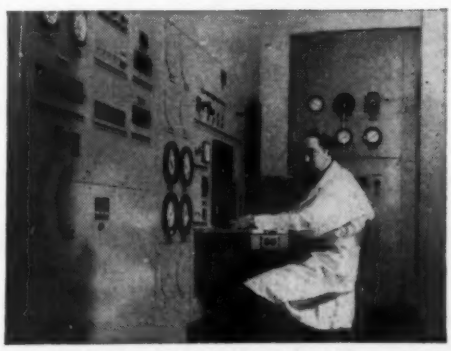
No date has been set for the 1954 Conference. It is anticipated that it will be held in either October or November.

GREER TOPICS **Important News of Aviation & Industrial Test Equipment**

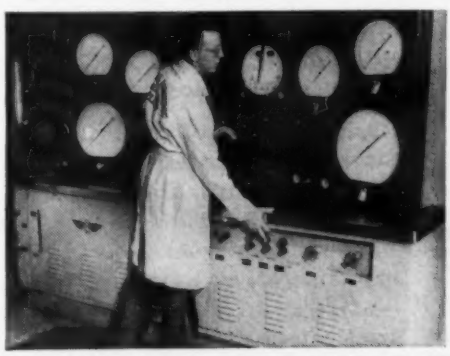


This photo shows instrumentation and control panels for testing the J-47 jet engine. GE engineer has an unobstructed view of engine under test through window at right.

Testing the J-47 Jet Engine with Greer Equipment



Another test cell for checking jet engines. General Electric test standards are among the nation's highest. Greer helps maintain them.



Shown here is the control panel for nozzle test stand. This, like other equipment shown was built in closest collaboration with GE.

Greer test machines used to maintain high quality control at GE engine plant

Why does General Electric use Greer test machines in checking the J-47 engine? Is it Greer accuracy? Dependability? Experience? It's all of these, of course, and more. Greer points to an unequaled record for service to the industry; a reputation that guarantees complete satisfaction; a list of customers reading like a "Who's Who" of the aviation world.

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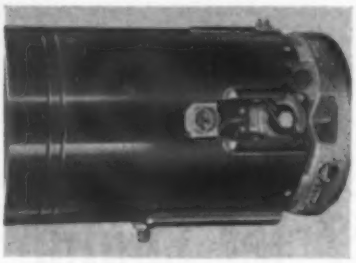
NEW PRODUCTS

Components, tools and equipment designed to improve operation of fluid power systems are described here . . . for more information fill in and mail the post card bound in this issue.

Continued from page 26

AIR COMPRESSOR . . . has integral controls

Design: A new high-pressure dc driven air compressor, which provides a complete self-contained air source for aircraft pneumatic systems.



Construction: The compressor features a cross-yoke construction between the sets of opposing cylinders thereby eliminating two connecting rods for the four pistons. A planetary reduction gear designed for use between the drive motor and compressor permits height and weight reduction. Capacity of the hydraulic model is 3 cfm at 3000 psi.

Application: Adaptable to either dc, ac or hydraulic drive, this unit is presently used in Lockheed, Martin and Grumman aircraft.

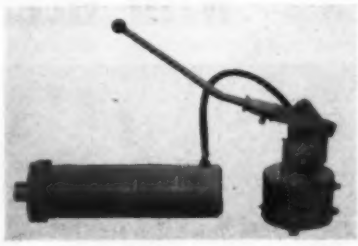
Rhodes Lewis Co., a subsidiary of McCulloch Motors Corporation, Los Angeles, Cal.

Circle 234 on Reader Service Card

HAND OPERATED HYDRAULIC PUMPS . . . features two plungers

Designation: Duo 2 Stage

Design: Can be supplied in standard form with or without pressure release key and with a reservoir capacity of either ½ gallon or 2 gallons, suitable for foot mounting. Constructed throughout from steel. They are absolutely free from leaks. The body consists of 2 plungers which deliver the maximum volume of oil under low pressure, in order to move the ram up to its working position quickly and then by means of manual device, the low pressure piston is automatically cut out and pumping is continued at high pressure to a maximum of 5000 psi. The body is bored straight through to receive the pistons, thus ensuring that minute pieces of swarf do not become lodged in the machined oil ways resulting in hydraulic failure. Under low pressure 1 pint of oil can be delivered by only 8 strokes of the handle using the combined pistons.



Chamberlain Industries, Ltd., of Staffa Road Leyton, London, England

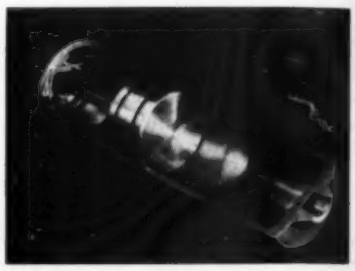
Circle 235 on Reader Service Card

HYDRAULIC CYLINDERS . . . have close tolerances

Designation: Koldflo Process

Sizes: The cylinders are cold extruded to final dimensions in press dies, and can be formed in sizes ranging from 1 to 6½ in. in diameter, in any wall thickness down to .060 in., and larger sizes can be extruded up to 42 in. long.

Features: One of the outstanding features of the cylinders is the extremely smooth surface with no grinding or tooling marks. They will operate under pressures up to 3000 psi. They have smoothness, hardness, strength. Extremely close tolerances are obtained without machining, grinding, boring or heat-treating.



Application: Steel cylinders with glass-smooth surfaces and without taper are applicable to the hydraulics industry.

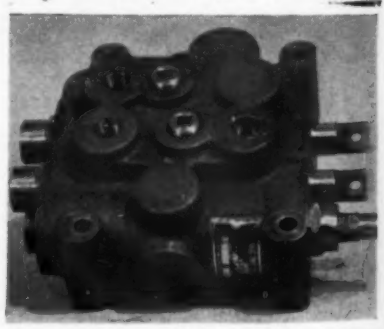
Mullins Manufacturing Corporation Koldflo Division Salem, Ohio

Circle 236 on Reader Service Card

HYDRAULIC CONTROL VALVE . . . for 2000 psi

Designation: Model 3500

Construction: Made of special alloy cast iron and is available in series or parallel circuit.



Features: Capacity is 15 gpm and pressures up to 2000 psi. The valve is furnished in 1-2-3-4 plunger cast en bloc. There is an exclusive check valve arrangement.

Hydraulic Unit Specialties Co., Waukesha, Wisconsin

Circle 237 on Reader Service Card

In hydraulic systems

SUNTAC CUTS LEAKAGE AN AVERAGE OF 35%

This amazing average has been established by years of extensive use in many different industrial hydraulic systems. And results are immediate—leakage is reduced as soon as Suntac Oil is put in the system.

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INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

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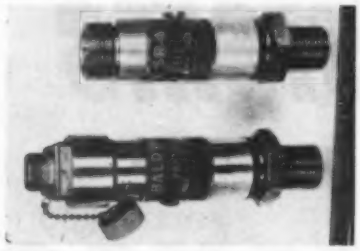
PHILADELPHIA 3, PA. ◆ SUN OIL COMPANY LTD., TORONTO & MONTREAL

PRESSURE CELLS
. . . with high frequency

Designation: SR-4 Type HF



Design: High frequency pressure cells consist of a pressure sensitive tube on the outside of which special SR-4 strain gages are bonded. Pressure changes may be measured by means of electrical indicator or recorder of the potentiometer type, but the cells are usually connected to operate as oscilloscope for high frequency response.

Capacities: 1000, 2000, 5000, 10,000 and 20,000 psi.

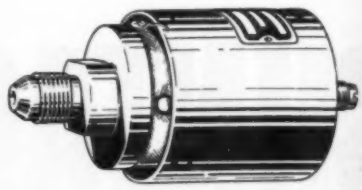
Construction: Upper frequency response is almost never limited by the pressure cell but by cavity resonance of the tank or piping connected to it. In addition to fast response to pressure variations the new pressure cells have exceptionally high accuracy and sensitivity and are of rugged construction. Long fatigue life is assured by the absence of moving parts. Temperature compensation is provided over a wide range to prevent changes of zero and sensitivity. High accuracy can be obtained also in static pressure measurements in a range from 60 F to 150 F.

Baldwin-Lima-Hamilton Corporation
Philadelphia 42, Pa.
Circle 238 on Reader Service Card

RELIEF VALVE
. . . for low pressure air system

Designation: Model RD-10280.

Design: The diaphragm is made of metal that is not affected by a range of temperature from –65 degrees to 165 degrees F. The valve has only one connection to the air system and is easily adjusted for blow-off pressure. Port for tube connection is 7/16-20NF-3 thread per AND10056, style E. The exhaust opens to ambient air. The cracking and resetting of the valve is accomplished within 2 psi of the valve setting. The cracking pressure may be set very close to the maintained system without loss of air through the relief valve. The valve has an adjustable



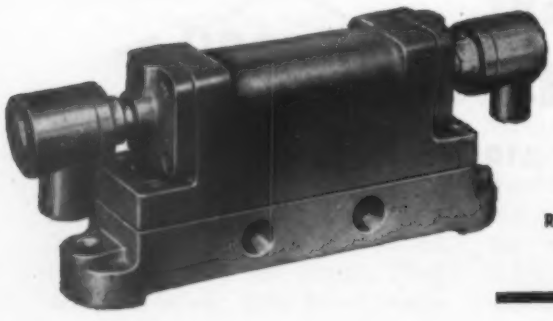
pressure range of 25 to 40 psi absolute.

Construction: Altitude and extreme temperatures have no effect on blow-off pressure. Metallic diaphragm balances out effect of atmospheric pressure so relief valve opens at exact preset system pressure under conditions of varying altitude.

Application: Principal use is to

NOPAK Model "V" Type AR, 4-Way Pilot Operated Slide Valve. Unbalanced piston shifted by energizing a normally closed 2-way solenoid pilot.

NOPAK Model "V" Type R, 4-Way Pilot Operated Slide Valve. Balanced piston is shifted by means of normally closed cam, hand, foot or solenoid bleeder pilots.



Widely Adaptable

NOPAK Model "V" 3-and 4-Way PILOT OPERATED SLIDE VALVES

Pilot Pressure or Bleeder Operated . . . these unique valves permit an infinite variety of cycling in the direct or remote control of continuous or intermittent cylinder action. They may be energized by means of 2-way hand, cam or foot poppet valves or with solenoid pilot or bleeder valves. Light weight, all-aluminum construction, simple design and small size make them extremely versatile, and adaptable to many uses which other valves cannot fulfill. Operate at air pressures from 20 to 150 psi.

GALLAND-HENNING NOPAK DIVISION • 2743 S. 31st St. • Milwaukee 46, Wis.

Write for NOPAK Bulletin V

•

Representatives in Principal Cities

NOPAK
VALVES AND CYLINDERS
DESIGNED for AIR and HYDRAULIC SERVICE

safeguard pressurized radar or other electronic or tank equipment in aircraft.

Lear-Romec Division, Lear, Inc., Elyria, Ohio

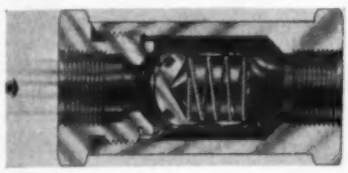
Circle 239 on Reader Service Card

CHECK VALVE . . . features low pressure drop

Designation: Free-flow

Sizes: ⅛ to 1 in.

Design: Spherical poppet nose and matching seat assures leak proof seal, because they are self aligning. The caged poppet gives low pressure drop, practically no flow restriction, in non-surge hydraulic systems to 3000 psi. While the standard opening pressure is as low as 3 ounces,



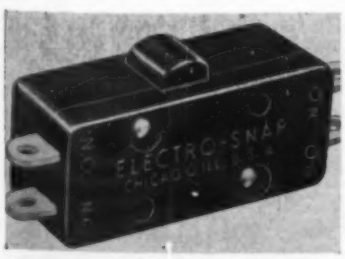
stronger springs are available so these units can be used as combinations of tube and pipe ports, for operating temperatures –65 degrees to 200 degrees F, and higher. Made in all metals.

Republic Manufacturing Company Cleveland, Ohio

Circle 240 on Reader Service Card

SNAP ACTION SWITCH . . . has hammer blow force

Design: The switch maintains an exceptionally high contact pressure of at least 45 grams until the instant the contacts

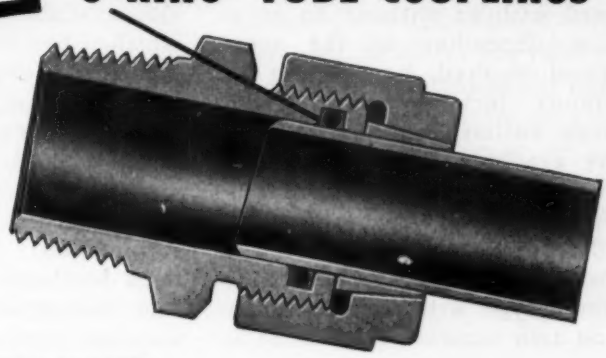


snap over. This increases reliability where vibration can cause other switches to operate prematurely. The contacts snap over with hammer-blow force of 150 to 200 grams contact pressure, reducing arcing and increasing electrical capacity.

Features: The switch may be

Circle 62 on Reader Service Card

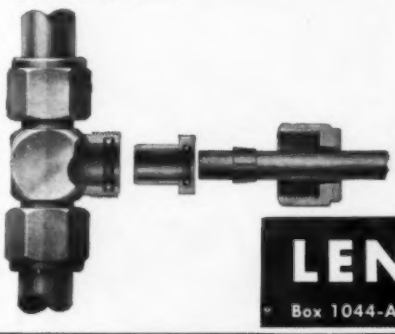
LENZ "O-RING" TUBE COUPLINGS



ELIMINATES FLARING, THREADING, WELDING, SOLDERING

A HACKSAW AND FILE IS ALL YOU NEED

Excessive wrench torque is unnecessary for seal does not depend upon tightness of the nut. Nut fits loosely on the tube for ease of assembly. The higher the pressure the tighter the grip. LENZ FITTINGS are ideal for quick, simple, easy to assemble, leak-proof connection — for steel or copper tubing — on air and hydraulic systems.

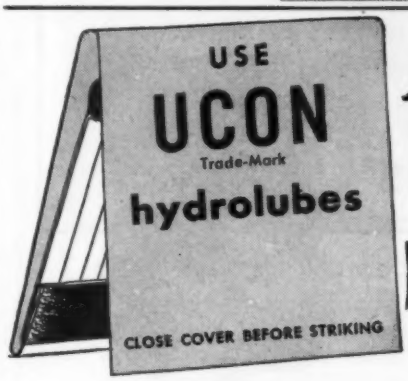


DO YOU KNOW ABOUT LENZ REDUCER COUPLINGS?

Reducer couplings are adapters for standard bodies, making possible line reductions on any leg by use of standard adapters and adapter nuts.

LENZ COMPANY

Box 1044-A • Dayton 1, Ohio • ME. 2557—MI. 7985



2 WAYS to PREVENT FIRE

Ucon hydrolubes are used in hydraulic equipment for the same reason that the warning line is printed on match-books—*to prevent accidental fires.*

Ucon hydrolubes are water-base hydraulic fluids that are non-flammable as long as the recommended water concentration is maintained.

They have good lubricity and contain effective corrosion inhibitors. AND they have no harmful effect on packings and seals—you don't have to revamp your equipment.

Write today for the booklet, "Ucon *Hydrolubes*", *F-7380.*

Carbide and Carbon Chemicals Company

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used with or without an actuator, depending on the overtravel required. A variety of actuators including lever, leaf, push button and toggle types are available for use with the switch.

Specifications: Rated at 15 amps, 125/250 v. ac or 30 v. dc, the switch is a single pole, double throw type with four terminals and two separate circuits. It is also available in a reset model which, when actuated, holds the contacts in one position until a second button is pushed. This model is recommended for overpressure and other over-limit safety uses and for reversing control.

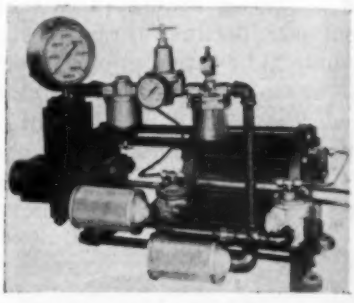
Application: The switch has been developed for use in severe vibration applications or for very accurate control with slow moving cams and pressure operated devices. Efficient for use on heavy presses, earth-moving equipment and aircraft.

Electro-Snap Switch and Mfg. Co., Chicago, Illinois

Circle 241 on Reader Service Card

HYDRAULIC PUMP . . . is air driven

Design: Available in single or double acting models. Is a simplex horizontal type and meets



demand for small volume capacity at medium and high pressures. Develops up to 20,000 psi operating on 90 psi air supply. Is self-contained and complete with air filter, regulator, lubricator and pressure gage.

Applications: Testing tubing, valves and pressure vessels and for supplying power for small molding presses.

The Aldrich Pump Company, Allentown, Pa.

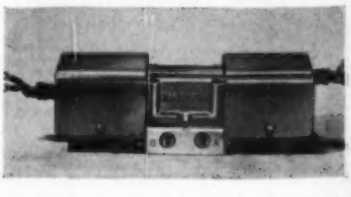
Circle 242 on Reader Service Card

4-WAY AIR VALVES . . . are solenoid operated

Designation: P-M Models CC1-25 and CC11-25

Size: ¼ in.

Design: Model CC1-25 is the single solenoid model, and the single valve stem, which is the only moving part, is spring returned. Model CC11-25 has two



solenoids, and its single valve stem remains at either end of its short stroke until the other solenoid is momentarily energized to return it. This makes "momentary contact" operation possible, eliminating the necessity,

★Whether heavy-duty or light-duty, high-speed or low-speed, from oil burners and blowers to pumps and agitators, there is a LOVEJOY Flexible Coupling to meet your exact requirements. They offer the best obtainable insurance against alignment troubles—dampen and absorb starting torque, vibration and shock of intermittent loads . . . protect motor and driven machine . . . lengthen bearing life.

LOVEJOY Flexible Couplings are compact in construction, durable, and provide excellent resiliency. Bodies carefully machined. Cushions available in materials suited to the particular load conditions . . . can be changed without shutdown. **No lubrication needed.**

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LOVEJOY FLEXIBLE COUPLING CO.

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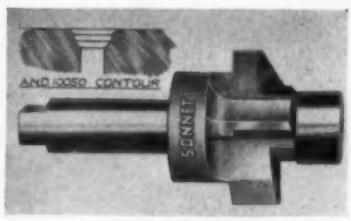
with a single solenoid valve, of keeping the solenoid energized as long as it may be desired to hold the valve in its shifted position. The need for a "holding" relay is eliminated.

Features: Another feature of the valve is that pipe or tubing connections are to a separate manifold, to which the valve mounts. The valve body and the solenoid can be removed for servicing by removing four cap screws, without disturbing line connections.

Hannifin Corporation
Chicago, Illinois
Circle 243 on Reader Service Card

COUNTERBORE TOOL
. . . does job in one operation

Design: A standard carbide tipped tool has been developed to produce the Army and Navy AND-10050 port or connecting

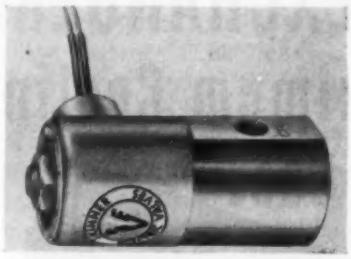


holes for hydraulic valves and fittings. Ths tool has four flutes with each flute performing an operation, thereby producing the form shown in the cutaway illustration. During the cutting cycle, the tool is piloted in the minor thread diameter to insure concentricity. The tool is carbide tipped to give long life and good finish in both ferrous and nonferrous material. Both the pilot and shank of the tool are hardened and ground. This counterbore has been tested by manufacturers of hydraulic fittings and equipment.

Sonnet Supply Company,
Hawthorne, Cal.
Circle 244 on Reader Service Card

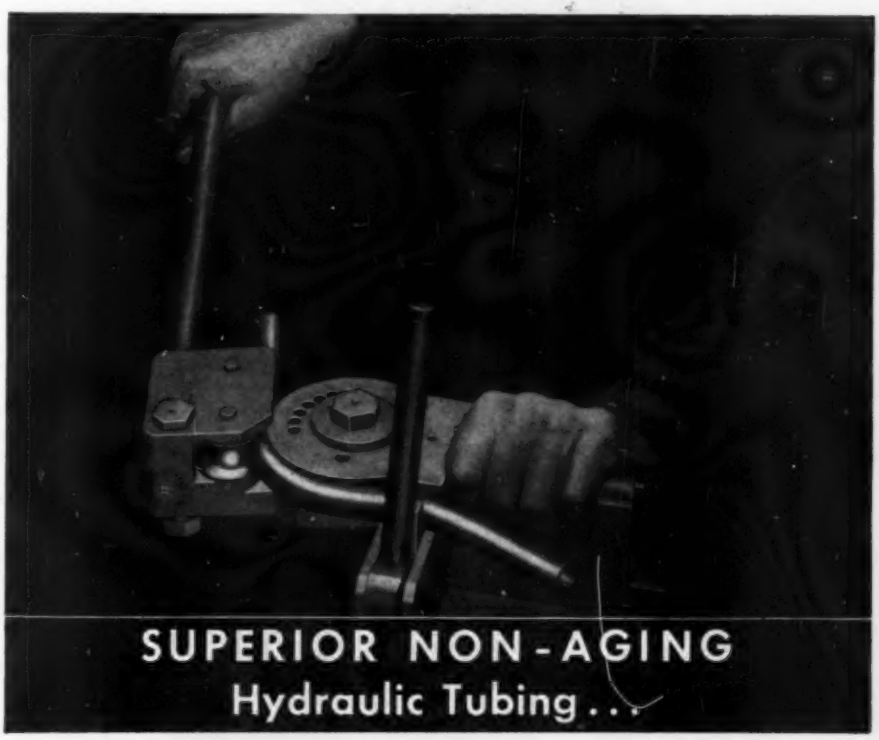
HYDRAULIC VALVE
. . . high pressure miniature

Designation: V10-1000
Sizes: ⅛ in NPT threaded ports, effective orifice diameter of 3/32 in. The actual size of the valve is 3-7/16 high and 1-5/8 in diameter.
Construction: All internal parts of the valve are stainless steel, the slide mechanism has a preci-



sion ground piston and a bore held to close tolerances.

Application: The unit can be utilized as a two or three way valve in either the normally open or closed positions. Principal application for the valve will be found in the automatic operation of single and double acting hydraulic cylinders or for pilot control of large three and four way hydraulic valves. It is capable of handling hydraulic fluids at pressures up to 1000 psi, and where remote control devices



SUPERIOR NON-AGING
Hydraulic Tubing . . .

100% Better Workability Than Ordinary Steel Tubing!

There's a reason, of course, why Superior's special, cold drawn, seamless hydraulic tubing is so much more ductile than common tubing . . . It is drawn from hollows made from aluminum-killed tube billets, under special melting practice. And carbon content is held to .12% maximum. (Did you realize that JIC Standards allow up to .18% maximum carbon content?)

***Result:*—NON-AGING tubing of exceptionally low yield strength and unusually high elongation. The relatively thin walls and smaller outside diameters make it easy to form long sweep bends and eliminate many fittings—or bend to close radii in cramped spaces.**

All Superior hydraulic tubing receives a 100% hydrostatic test before delivery and each order is tested for flareability. You may specify Superior tubing in any size from ⅛" to 1⅛" O.D. Our new folder gives sizes, wall thicknesses and recommended maximum working pressures. The coupon will bring you your copy.

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THE BIG NAME IN SMALL TUBING

All analyses .010" to ⅜" O.D. Certain analyses (.035" max. wall) up to 1⅜" O.D.

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Please send me at once your newest folder on Superior Hydraulic Tubing.

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Circle 121 on Reader Service Card

YOUNG HEAT EXCHANGERS
Provide Maximum Cooling
at Minimum Cost

- Efficient
- Lightweight
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Design Features

1. Smooth inlet and outlet flow bonnet.
2. Light and strong die-formed header.
3. Engineered baffle-spacing.
4. Precision parts prevent by-passing.
5. Non-ferrous shell and tube bundle.
6. For vertical or horizontal mounting.

Young Heat Exchangers provide maximum cooling at minimum cost. They are designed for any kind of fluid to fluid cooling for a variety of chemical and process applications under maximum operating pressure of 75 psi and temperatures up to 300° F.

Manufactured in a complete range of sizes, single and multi-pass, fixed tube and removable tube bundle, the units are built of ferrous or non-ferrous metals. Write for Catalogs 1049 and 1149.

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Heat Transfer Products for Automotive and Industrial Applications. Heating, Cooling and Air Conditioning Products for Home and Industry.
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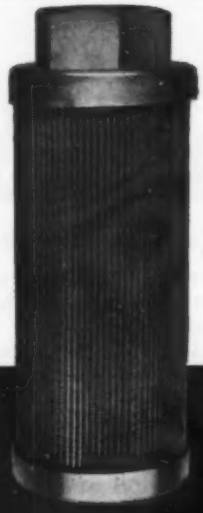

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★MEETS J.I.C. STANDARDS
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CAPITAL HYDRAULIC OIL FILTER
WITH MONEL METAL INSERT

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SIZES AND SCREENS TO FIT YOUR NEEDS

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5837 South Ashland Avenue Chicago 36, Illinois

New Products

have heretofore been considered impractical, automatic control of implements used in conjunction with tractors and other farm equipment.

Skinner Electric Valve Division, Skinner Chuck Company, New Britain, Conn.

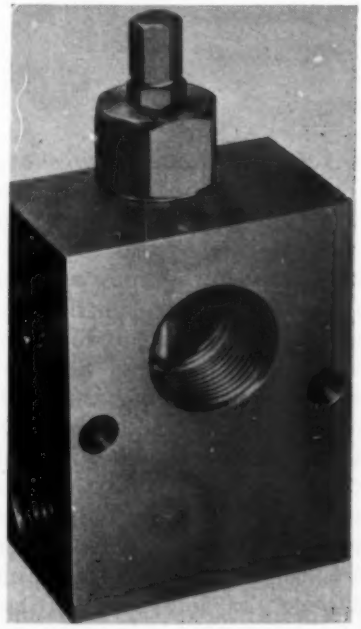
Circle 245 on Reader Service Card

In the item "Shut-Off Valve for Vacuum Service", pages 180-181 of the October issue, the top pressure recommended for the operation of the "Red Head" packless valve made by Imperial Brass Mfg. Co., was given as 3000 psi. This was in error. The correct top pressure is 300 psi.

RELIEF VALVES
. . . hold constant pressure

Size: 1 in.

Design: These pilot type relief valves have a small pilot valve controlling the action of a



larger main valve. The valve is designed to hold pressure constant regardless of flow. The main valve is only responsive to the flow through the pilot. The main valve positions itself to maintain this pilot flow constant and any change in pressure point affects the pilot which in turn controls the main valve. High capacity is obtained by the sliding spool construction.

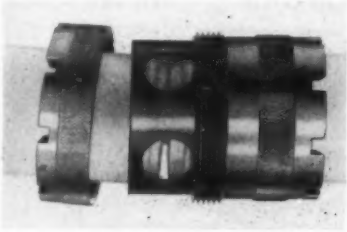
Features: Relief pressure is constant and is not affected by flow,

temperature or oil viscosity.
Specifications: Relief pressures are adjustable 50 to 1000 psi or 500 to 3000 psi. Capacity is 40 gpm at 200 psi or greater.

Fluid Controls, Inc.,
Mentor, Ohio
Circle 246 on Reader Service Card

COUPLING FOR METAL TUBES
. . . saves aircraft weight

Designation: WIG-O-FLEX
Sizes: 1, 1¼, 1½, 1¾, 2, 2½, 3, 3½, 4 in.
Features: The coupling or union transforms metal tubes into flexible assemblies. The use of this light weight metal coupling reduced the weight on a new



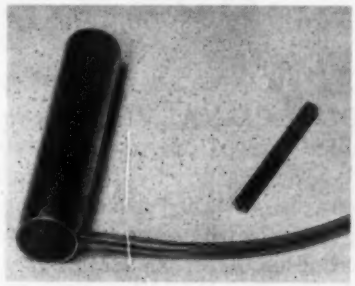
type bomber more than 17 lbs. It can be installed in small apertures in the plane's structure. It is capable of taking care of misalignment to 1/6 in., tube separation to ¼ in., and allows at least 4 degrees tube flexure. It cannot blow apart because its design provides metallic retention of the tube ends. The design allows this union to serve as a good slip joint, or to function as a packing gland. Tests have shown it to be leakproof even at three times the pressure encountered in current jet aircraft. It maintains a tight seal in temperatures ranging from –65 F to about 600 F.

Application: While this coupling was designed primarily for use in aircraft, it can be used on any equipment where gas or liquid is transferred.

E. B. Wiggins Oil Tool Company
Los Angeles 23, California
Circle 247 on Reader Service Card

VELOCITY PICKOFF
. . . for high sensitivity

Designation: LVsyn
Design: A shielded cylindrical coil assembly having a coaxial hole and a cylindrical high-coercive force permanent-magnet core. The core is free to move in the coaxial hole which runs the full length of the coil assembly. The relative velocity of the core with respect to the coil assembly



results in the output signal. The sensitivity is a function of the size of the pickoff. If the pickoff has a stroke of 1 in., it will have a sensitivity of 450 millivolts per inch per second.
Application: Used in control systems requiring velocity feedback and in machine design and ballistic instrumentation problems.

Control Components Company
Brookline, Mass.
Circle 248 on Reader Service Card

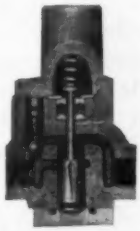
COMPACT DEPENDABLE EFFICIENT

Double acting hinge mounting BHEW hydraulic cylinder.

BHEW HYDRAULIC CYLINDERS

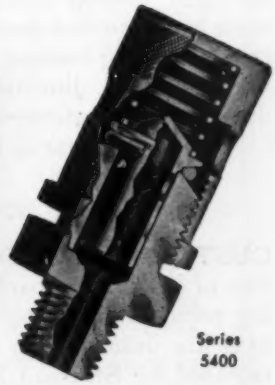
It's easy and practical to use BHEW hydraulic cylinders in your applications. Accurately honed barrels, hard chrome-plated rods, small O. D. and any type mounting desired are BHEW cylinder features. All types and sizes available in standard and special O. E. M. designs. BHEW makes single and double acting, high and low pressure cylinders with cup-type, ring-type or O-ring construction. Send specifications of your requirements.

BHEW Pressure Operated Hydraulic Flow Control Valves, for lift trucks, eliminate surge as load starts down. Load weight controls rate of descent, full speed raising and empty fork travel. Write for details.



BENTON HARBOR ENGINEERING WORKS
BENTON HARBOR, MICHIGAN

At Last!
A Relief Valve that DOESN'T LEAK
for pressures from .75 to 100 psi



Series 5400

Features: An extremely precise, adjustable, low-pressure pop-off relief valve providing "dead-tight" sealing up to the cracking pressure—quick reseat with zero leakage. Available in five pressure ranges.

Design: Incorporates "Circle-Seal" principle employing a standard, resilient "O" ring self-aligning between conical seats of a poppet type valve. Standard "O" ring is used for very low pressures. For higher pressures the "O" ring is supplied with a metal "back-up" ring.

Construction: Aluminum or brass in standard design; stainless steel to order. Connection sizes ⅛" or ¼" male pipe, standard; $\frac{7}{16}$"-20 or $\frac{3}{8}$"-18 straight thread, to order.

Service: For controlling gases safe to release into the atmosphere in systems where leakage cannot be tolerated or is undesirable for reasons of economy. Temperature range: —40°F to 280°F, standard; —80°F to 400°F, to order.

Another CIRCLE SEAL *precision valve*

Engineering Data Free on Request.

JAMES-KNI-CALT
2181 E. Foothill Blvd. • Pasadena 8, Calif.

USEFUL LITERATURE

You'll find many valuable production and design ideas in publications described here . . . copies will be sent you free without obligation

Continued from page 34

CONTROL VALVE . . . which is solenoid controlled-piloted operated is described in a booklet SK-53 released by Valvair Corporation. The operation of the valve is completely explained together with outstanding features and sizes available. A cross-sectional view of the pilot valve and main valve identifies each part. The entire line of valves is illustrated and also included are details and specifications necessary for installations. Some of the valves covered are 3-way foot-mounted, 4-way sub-base manifold-mounted and 4-way-5 port sub-base manifold-mounted.

Circle 182 on Reader Service Card

SWIVEL JOINTS . . . "Self-aligning Swivel Joints for Piping" is the title of a new 12-page bulletin No. 265-A which has just been published by Barco Manufacturing Company. The swivel consists of a short pipe nipple terminating in an enlarged hemispherical section or ball which seats on a molded gasket, housed inside an outer casing. Spring loading maintains a tight seal. The various styles, dimensions and sizes available for different applications are completely described.

Circle 183 on Reader Service Card

CUSTOM MOLDED PARTS . . . A complete line of "O" rings, back-up rings, hydraulic packing permadizing, molded gaskets and other products are described in a 26 page product catalog released by Stillman Rubber Company. Some of the subjects covered in the catalog are, "O" ring installation recommendations, non-moving seals, dimensional data for "O" rings, commercial and aircraft "O" rings, fuel resistant "O" rings, rubber to metal bonding, and tests reports. Many sketches are used to illustrate the variety of applications.

Circle 184 on Reader Service Card

SOLENOID VALVES . . . Literature has been released by Eclipse Fuel Engineering Co. on their "DO" solenoid valves. Bulletin M-500-T covers information such as applications, sizes and types, construction features and operation. Specifications and prices are tabulated for the solenoid valves, for service with air-gas, water, oil, heavy oil, low pressure gas, high pressure gas and air, also for hot or cold water. These valves, the literature also states, may be activated by various switches, timers and other automatic controls.

Circle 185 on Reader Service Card

WORM GEAR MOTORS . . . An attractive 8 page brochure in color, F-1650, describing their right-angle worm gear motors has been issued by U. S. Electrical Motors, Inc. Many design and construction features are discussed and illustrated. Many sectional views add much in aiding to present design features. It is pointed out that the motor and gears are mounted on a single supporting base. Motors range from ¼ to 30 hp and from 5 to 1000 rpm.

Circle 186 on Reader Service Card

ANNIVERSARY BOOK . . . The Standard Pressed Steel Co. has released a 24 page booklet entitled "50 Years—A Start for the Future", in celebration of the company's 50 years of operation. It sketches very briefly the history of the company, then concentrates on being a history of the company's present and future. In text and some 60 pictures, the golden anniversary book shows a fast growing company in operation, reveals its policies, procedures and purposes in sections devoted to its employees, its products and progress.

Circle 187 on Reader Service Card

AUTOMATIC LUBRICATION . . . Trabon Engineering Corporation has released a bulletin on automatic bearing lubrication. Illustrated are transfer machines typical of several installed in the plant of a large automotive producer and another application is shown for lift trucks. Features of the centralized lubricating system, adaptable for both oil and grease requirements, are also presented.

Circle 188 on Reader Service Card

VIBRATION ISOLATORS . . . The Barry Corporation has issued a Bulletin No. 534, which provides a complete technical description of vibration isolators of the knitted-wire type. Infor-

Circle 119 on Reader Service Card

WIGGINS **INST-O-MATIC** COUPLINGS

QUICK—DISCONNECT

3000 psi

Manual Quick Disconnect (Push-Pull Positive Action)

Automatic Quick Disconnect (Breaks Away at Pre-determined Weight Load)

for high pressure HYDRAULIC FUEL and PNEUMATIC Systems

SIZES: 1/4" TO 2 1/2"

WRITE FOR FURTHER INFORMATION

Wiggins

E. B. WIGGINS OIL TOOL COMPANY, INC.

3424 East Olympic Boulevard, Los Angeles 23, California

The right gauge for your product

...is in the new MARSH CATALOG

Turn the pages of this catalog, and you'll know why the most discriminating manufacturers equip their products with Marsh instruments.

Hundreds of types, styles, mountings and ranges are covered; all share one common attribute . . . the best and most economical you can buy for a given set of design and service conditions.

MARSH INSTRUMENT CO., Sales affiliate of Jas. P. Marsh Corporation, Dept. 19, Skokie, Ill., Export Dept. 3501 Howard St., Skokie, Ill.

Automatic Valve Operation With No Electrical Power!

NEW! ASCO®

Pressure Operated Manual Reset Valves

Reduce Hazards!

Provide Reliable Operation!

APPLICATIONS—Bulletin 8035 Valves are ideal for remotely controlled, safety shut-off applications where it is not desirable to depend upon electrical power for operation. Valves are *pressure operated*, thus:

A. eliminating explosive hazards encountered with electrical operation.

B. assuring completely reliable operation where electricity is undependable or non-existing.

AVAILABILITY—Two types:

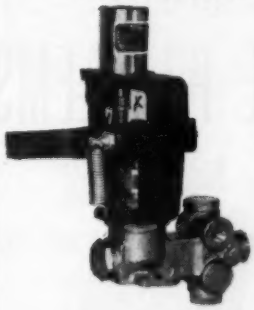
(1) Trip on pressure failure.

(2) Trip on pressure application.

Standard Valves are constructed of bronze, cast-iron, steel, and stainless steel. Other materials are available if required. Valves can be provided with auxiliary switches for indicating lights or electrical control circuits.

MOVEMENT	PIPE SIZES (Inches)	Maximum PRESSURES (lbs./sq. in.)
2 Way*	3/8-6	600
3 Way	1/4-1/2	300
4 Way	1/4-3/4	250

Normally open or normally closed



OPERATION — Valve is manually set and remains in operating position until pressure is lost or applied (depending upon Valve type). Once tripped, the Valve must be manually reset.

ASCO Solenoid VALVES

ASCO Electro-Magnetic CONTROLS

ASCO lists hundreds of standard valve types and maintains an engineering service for special designs. We manufacture a complete line of Electromagnetic Controls, including Automatic Transfer Switches, Remote Control Switches, Contactors, Relays, and Complete Control Panels.

Write for Free Literature!

Automatic Switch Co.

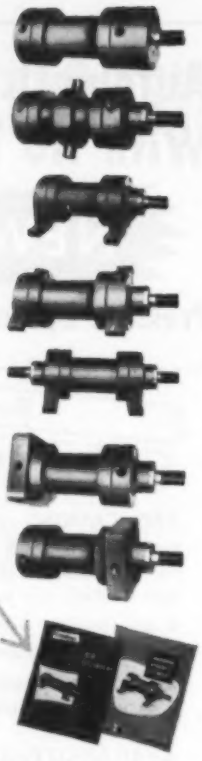
385-H LAKESIDE AVENUE ORANGE NEW JERSEY

Circle 63 on Reader Service Card

CYLINDERS!

CYLINDERS!

CYLINDERS!



Lindberg builds a complete line of standard heavy duty air and hydraulic cylinders..up to 12".

Lindberg also builds super heavy mill type cylinders for extremely tough and heavy jobs.

Ask for bulletin #731 (air)..#701 (hydraulic).

AIR . . HYDRAULIC
LINDBERG CYLINDERS

Lindberg Air and Hydraulic Division

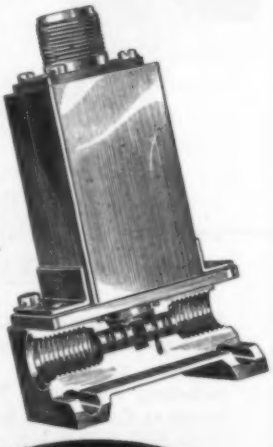
Lindberg Engineering Co. • 225 No. Laflin St. • Chicago 7, Ill.

NEW *VALCOR* PRINCIPLE IS SOLVING MORE SOLENOID VALVE PROBLEMS

*Valcor Floating Shear Seal: Simple design eliminates need for precision fits. Seals 100% in both directions . . . and seal improves with use because of self-lapping. Self-cleaning, cannot clog because of exclusive floating shear seal action.

• Straight-Through Flow: Absolute minimum pressure drop.

• Sealed-in-Coil: Never an electrical failure reported. Built to withstand shock, vibration, and the elements.



Send for free booklet— "The Valcor Solenoid Valve with the Floating Shear Seal."

Valcor Engineering Corp.
Carnegie Ave.,
Kenilworth, N. J.

VALCOR
Solenoid Valves

*Pat. Pending

Useful Literature

mation contained in the bulletin includes transmissibility in all directions of motion, isolation curves for acceleration and displacement, the effect of load variation, the effect of extreme high and low temperatures. Included also is vibration isolation performance after severe shock, selection of isolators for unsymmetrical loads, detailed dimensions and construction data for unit isolators, complete bases and load ratings. Performance data is also submitted.

Circle 189 on Reader Service Card

ROLLER CHAIN SPROCKETS . . . A pocket size catalog No. B55-53 has been prepared by Morse Chain Company. An interesting feature of the catalog is that it is printed on oil and moisture resistant paper. Tables in the catalog give horsepower ratings, taper-lock bushings and sprocket specifications. Roller chain and part specifications for various chain pitches are also included. Complete prices are listed. Installation and removal procedures for taper-lock sprockets are described, as well as horsepower selection charts, drive selection procedures and service factor tables.

Circle 190 on Reader Service Card

LIQUID LEVEL GAGE . . . Jerguson Gage & Valve Company has issued Bulletin No. 207 which covers information on their new convex scale for their remote reading gages. Visibility and construction features are explained. Correct level readings are always positive, with no distortion inasmuch as the scale and indicator are closer together and formed in the sane convex curvature.

Circle 191 on Reader Service Card

AIRCRAFT VALVES . . . A booklet consisting of 16 pages has been issued by Pacific Airmotive Corporation covering aircraft pressurization and temperature control equipment for high speed high altitude aircraft. Interesting information concerning the company covers engineering facilities, research and development, fabrication and assembly. Other sections describe complete with specifications, photos and line drawings, subjects such as cabin pressure regulators, cabin safety valves, mass flow and temperature control valves, rotary actuators, motor operated air valves and others.

Circle 192 on Reader Service Card

SAFETY SWITCHES . . . A bulletin SS-15 has been issued by Federal Electric Products Company describing their safety switches. The 28 page booklet with the help of many illustrations, describes in detail the features of the switches, including their front operated, visible-blade

switch. Presented, is one type switch up through 1200 amperes, a double-throw switch up through 600 amperes and another type up through 400 amperes. Features of the front operated industrial switch is graphically shown in drawings and plates. Illustrated and described in detail is the high pressure fuse holder, which eliminates heat-creating joints near the fuse clips. The following features are described; positive action, beneath-the-blades operating crossbar with double fibre insulation and the unit pole block construction. Information on arc snuffers and arc mufflers is also presented.

Circle 193 on Reader Service Card

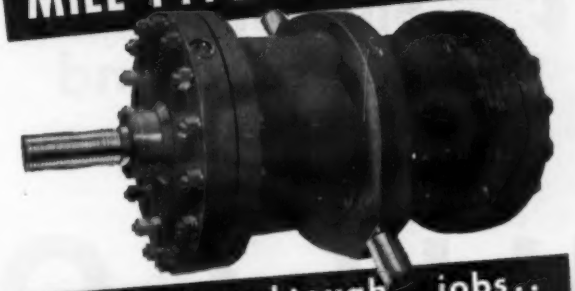
THREAD PROTECTOR . . . CaPlugs, Division of Protective Closures Company, Inc., has issued a bulletin describing the characteristics, uses and sizes of the protectors. The plastic from which the CaPlug is made is practically inert and is impervious to all common chemical reagents. The plugs are described as being designed so that all standard sizes will fit any diameter as caps or as plugs, inside or outside threaded or plain. Special requirements can be handled by their Technical Department.

Circle 194 on Reader Service Card

CONTROL VALVE . . . A diaphragm operated control valve is described in Bulletin D-53, Number 1 issued by the A. W. Cash Valve Manufac-

Circle 122 on Reader Service Card

HEAVY DUTY
MILL TYPE CYLINDERS



For rough and tough jobs . .
. . Air and Hydraulic

Lindberg Mill Type Cylinders are heavy, tough cylinders . . with plenty of guts built in. They'll handle the meanest and most demanding job you can think of, and they'll perform dependably under the most adverse operating conditions.

Lindberg also builds a standard catalog line of heavy duty air and hydraulic cylinders . . up to 12". Hydraulic Cylinders available in 1500 and 3000 PSI. Ask for bulletin #731 (air) . . #701 (hydraulic).

LINDBERG AIR . . HYDRAULIC CYLINDERS

Lindberg Air and Hydraulic Division
Lindberg Engineering Co. 225 No. Laflin St., Chicago 7, Ill.

COMPRESSED AIR AND GAS COME OUT OF THE LOGAN

ARIDIFIER

Scrubbed CLEAN AND DRY

INSTALL ARIDIFIERS ON LINES SERVING

- Paint Spray Guns
- Air Tools
- Air Hoists
- Foundry Jolting Machines
- Sand Blasting Tools
- Sand Blasting Rooms
- Metal Spray Guns . . . or Wherever the line must deliver clean, dry air or gas

On any air or gas line 92% of the dirt, oil, scale and water that enter the Aridifier is trapped and removed from circulation. The Aridifier's patented centrifugal-baffle action scrubs air and gas clean and dry . . . protects equipment, prevents freezing, fouling, corrosion and caking, produces best results with spray gun and air tool operations, etc. Easy to install. Self cleaning. Maintains itself. 10 models available. Capacity 7 CFM to 17,000 CFM.

Learn HOW the Aridifier scrubs with a patented centrifugal-baffle action.

Write for This Catalog

Now!

Logan ENGINEERING CO.

4920 W. Lawrence Ave., Chicago 30, Ill.

UNBRAKO®

dryseal-thread

PRESSURE PLUGS

HOW THEY WORK

In tightening of UNBRAKO Pressure Plugs, the roots of the flattened threads actually crush the sharper crests of the mating parts. Major and minor diameters are positively sealed, pressure tight without compound. Stocked and sold by leading industrial distributors everywhere. Write for literature. SPS, Jenkintown 2, Pennsylvania.

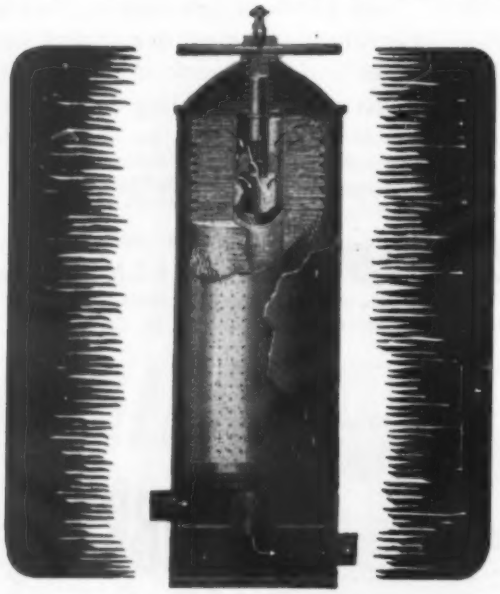
Our Fiftieth Year : A START FOR THE FUTURE

UNBRAKO SOCKET SCREW DIVISION

SPS

JENKINTOWN PENNSYLVANIA

Prevent
Sludging
Pump, valve and piston failures
with
HILCO
OIL FILTERS



SERIES "R" FILTER

Oil contamination is one of the largest single causes of hydraulic equipment failure. Eliminate dirty oil with HILCO filters . . . keep your oil clean by removing products of oxidation, acids, sludge and moisture. Increase the life of your oil and cut costly downtime with HILCO filters.

Years of experience and dependable service make **HILCO** your best filter buy.

★ *Recommendations at No Obligation*
FREE Descriptive Bulletin

THE HILLIARD CORPORATION
148 W. FOURTH ST. • ELMIRA, N. Y.

IN CANADA: — UPTON - BRADEEN - JAMES, LTD.
990 Bay Street, Toronto — 3464 Park Avenue, Montreal

Useful Literature

turing Corp. The applications, construction and features and sizes are outlined. One cross-sectional view shows the valve when normally open and another view shows it normally closed. All of the component parts are identified and installation dimensions are given.

Circle 195 on Reader Service Card

NON-RETURN VALVE OPERATOR . . . makes any simple butterfly valve a non-return or check valve. All of this is described in a Bulletin 160 prepared by Askania Regulator Company. Just what it is and exactly how it works is completely told. High power output, low pressure drop at maximum flow, low permanent pressure loss are some of the advantages outlined. Several other pieces of automatic control equipment including a pressure/flow regulator and ratio regulator are presented.

Circle 196 on Reader Service Card

CHAINS . . . Drive and conveyor chains are described in Bulletin 53-59 released by Chain Belt Company. Exploded view of a drive chain section and of a conveyor chain section shows how these chains are constructed. Many of the outstanding features such as controlled material selection and heat treatment and ease of coupling and uncoupling are outlined. A complete set of specifications is tabluated for offset sidebar (drive) chains and straight sidebar (conveyor) chains.

Circle 197 on Reader Service Card

CONTROL VALVES . . . A 12 page booklet LB-1 has been prepared by Conoflow Corporation describing their control valves. Features of the split-body construction are outlined. The method of operation is complete including sectional views for clarity. Air pressures, sensitivity and speed of response are some of the sections which are quite complete in outlining the story.

Circle 198 on Reader Service Card

PRESSURE PLUGS . . . Seal tight plugs are described in a 2 color bulletin, form 883 just released by Standard Pressed Steel Co. In pictures, drawings and text, the bulletin describes the sealing operation of the threads and the reasons for leakage with ordinary pipe plugs. Standard plug sizes from 1/16 to 1¼ inches are listed.

Circle 199 on Reader Service Card

GEARS AND CHAINS . . . A new catalog describing the entire line of stock gears, speed reducers, sprockets and chains, couplings and special gears, has been issued by Grant Gear

Works, Inc. Spiral bound for easy reference, this catalog contains 40 pages devoted entirely to useful tables and engineering information relating to power transmission. The booklet consists of 176 pages and is complete with illustrations of every description, such as photographs, line drawings, installation diagrams and gear layouts. Engineering data is complete.

Circle 200 on Reader Service Card

CENTRIFUGAL PUMPS . . . A new bulletin No. 237-C which describes 2, 3, and 4 stage centrifugal pumps has been issued by Pennsylvania Pump and Compressor Company. These pumps are available in 2, 2½, 3 and 4 inch sizes for a capacity range from 50 to 850 gpm and for heads up to 1400 feet. The impeller arrangement and the featured balance design are outlined. A typical sectional view of a two stage pump is complete with the identifying parts. A similar view is shown also for the 3 and 4 stage pumps

Circle 201 on Reader Service Card

SUPERCHARGER INTERCOOLER . . . Young Radiator Company has just published a new 2 page, 2 color catalog supplement for its Supercharger Air Intercooler Catalog No. 1652. The supplement describes both high and low pressure type intercoolers. It is fully illustrated, showing intercooler applications and features and includes cut-a-way sectional views. The original 4 page catalog No. 1652, features 2 types of supercharging systems now in common use with 4 cycle engines.

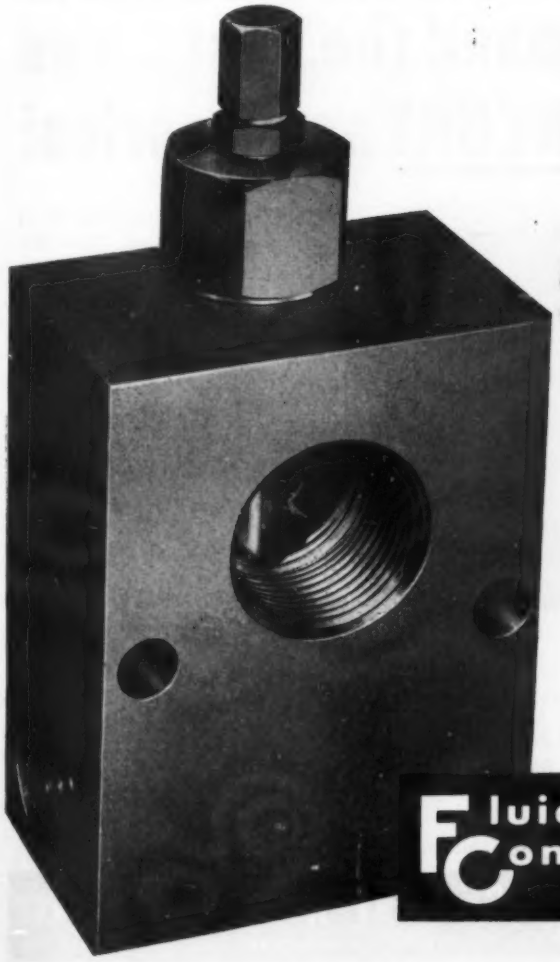
Circle 202 on Reader Service Card

SELF-STICKING MARKERS . . . W. H. Brady Company has released a Bulletin No. 122, describing the uses and applications for self-sticking markers, for wire and pipe write-on labels, safety signs, container markers, dotted line aisle markers, stencils and others. The bulletin also describes their new release coating which speeds up the removal of the marker.

Circle 203 on Reader Service Card

PUSH BUTTON . . . Assembly for panel mounting is described in a data sheet 77 released by Micro, a division of Minneapolis-Honeywell Regulator Company. The data sheet shows a photo of the part and an outline drawing showing identity of parts and thread sizes etc. It is used with Micro ISMI sub-miniature switch. The push button plunger mechanism is sealed at the panel, protecting the switch. Many subjects are discussed, including characteristics, contact arrangement, electrical rating and how to install the two sub-assemblies composing the 1PB4 push button assembly.

Circle 204 on Reader Service Card



NEW!

. . . for the Cost Conscious Design Engineer

LOW COST
1" Relief Valves

With these additional advantages

- BETTER PERFORMANCE
- DEPENDABLE LONG LIFE
- CONSTANT PRESSURE

• Total over-all size 2" x 3" x 5 21/32"

Write for complete specifications and prices

• For Oil • Relief Pressure—Adjustable 50 to 1000 P.S.I. or 500 to 3000 P.S.I.

Fluid Controls, inc.

MANUFACTURERS OF HYDRAULIC VALVES AND DEVICES
Relief Valves • Check Valves • Restrictor Valves • Needle Valves • Pilot Check Valves • Clamping Valves • Small Spring Loaded Accumulators • Special Valves

1284 N. CENTER STREET • MENTOR, OHIO

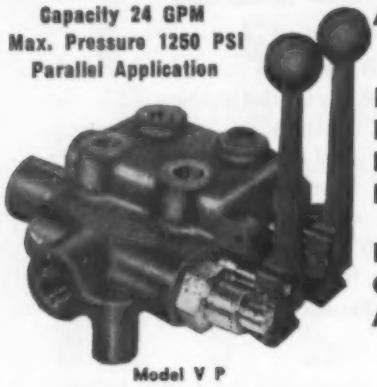
Circle 35 on Reader Service Card

Circle 46 on Reader Service Card

And Now-A Gre-Sen

MULTI-CONTROL VALVE

Capacity 24 GPM
Max. Pressure 1250 PSI
Parallel Application



Model V P

Another Gre-Sen

Engineering Triumph In Quality Hydraulics at Mass Production Prices.

For Mobile and General Industrial Applications.

FEATURES - - -

- Fully Balanced—Self Centering—Built-in Adjustable Relief Valve.
- Relief Valve Has Replaceable Hardened Seat
- Tripod Mounting Feet
- Check Valve Effective On All Spools
- Smooth Positive Easy Control
- Hardened and Chrome Plated Spools
- Two Position Control Handle 180°

Center sections are available making additional Controls in this Multi-unit.

Write for full details about this better built, money saving valve.

GRE-SEN MANUFACTURING COMPANY

628 Colfax Ave. N. Dept. H-123 Minneapolis 11, Minn.

Useful Literature

HYDRAULIC PROBLEMS . . . Need a problem solved? A folder has been released by Advanced Hydraulics, Inc., describing the service offered for solving individual problems. It is explained that the problems are given immediate attention and worked out to specific requirements. Many illustrations are included showing the types of equipment designed.

Circle 205 on Reader Service Card

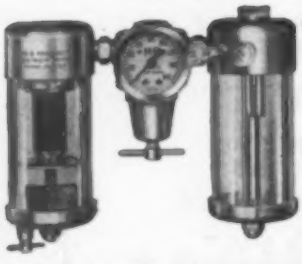
DRUM FILLER . . . The automatic drum filler is an installation providing a completely automatic means of filling drums to a predetermined weight. It is capable of handling liquids of any type and can be adapted for handling many types of dry solids. Complete description of the drum filler is given in literature offered by The Rucker Company. How the unit works and the principle features of the control circuit are outlined.

Circle 206 on Reader Service Card

FLEXIBLE SEALS . . . An attractive 16 page folder on flexible seals has been released by Fulton Sylphon Div., Robert Shaw-Fulton Controls Co. This booklet in color covers information complete for the types offered. Outstanding features and typical applications, internal and external sectional views of plastic and metallic

Prominent User Acclaims

"M-B" Automatic Air Line FILTER, REGULATOR and LUBRICATOR Assembly



The value of "M-B" Automatic Air Line Filters, Regulators and Lubricators is widely known for their effectiveness as a protection to Air Valves, Cylinders, Pneumatic Tools, etc.

"Your 'Sentinel of the Air Line' has been giving us very good service. We have had no complaints at all and I trust that we will be ordering more of them in the near future."

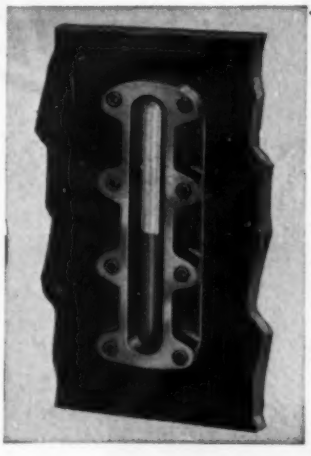
signed: **A. E. Cranston, Sr.**
PRESIDENT

Cranston Steel Strapping Co.
Oak Grove, Oregon

WRITE FOR LITERATURE

M·B PRODUCTS
46 Victor Ave.
DETROIT 3, MICHIGAN

Demand the best...use CENTURY accessories!



←For new or modernization of old reservoirs use CENTURY designed and built Sight Oil Level Gages.

Get the best. Use CENTURY→ designed Filler-breather Cap assemblies for all your reservoirs.

CENTURY HYDRAULICS, INC.

Circle 67 on Reader Service Card

Circle 21 on Reader Service Card

seals, bellows types, reed and flat types and rotary are all covered with informative material and illustrations.

Circle 207 on Reader Service Card

SOLENOID VALVE . . . Valcor Engineering Corp. has released a 12 page booklet describing their solenoid valve with the floating shear seal. The listing of the valve is given and many features and applications suggested. The valve consists of three basic parts, the plunger, the disc and the valve seats. The seats are loose inserts in the body, the plunger is a loose insert in the cylinder and seal disc is a loose insert in the plunger. Much more of this construction is outlined in the bulletin together with subjects such as—absolute minimum pressure drop and pressure drop vs. fluid flow.

Circle 208 on Reader Service Card

Oil Powered Wedge Topples Giant Trees

A manually operated hydraulic wedge has sufficient power to tip giant trees and to control their direction of falling. The compact unit consists of a hydraulic pump, a power cylinder and a tapered wedge, which is attached to the end of the piston rod. First tests of the wedge have just been completed by Hufford Machine Works Inc., in El Segundo, California.

The wedge, which is sheathed on each side by two

thin blades, is operated by inserting the blades in the saw kerf of the trunk. Pressure is manually built up in the pump, by means of the handle. The wedge, with a resultant force up to 90,000 pounds, is forced between the blades and is sufficient pressure to tip the largest of trees.

The wedge cannot be ejected from the kerf. Trees have been felled in the past by driving steel or wood wedges into the kerf with a sledge hammer. The smooth action of the hydraulic pump eliminates tree shock caused by hammers. Possibility, therefore, of injury from falling branches is greatly reduced.

Circle 70 on Reader Service Card

Seal of Proven Performance

Modernair

AIR/FLUID POWER

Equipment Specialists

Valves • Chucks • Cylinders • Silencers
Solenoids • Hydraulic Pumps • Compressors
Pilots • Air Controls • Machine Feeds
Clamp Cylinders • Quiet Exhausts

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Stocks in Principal Cities

Modernair CORPORATION

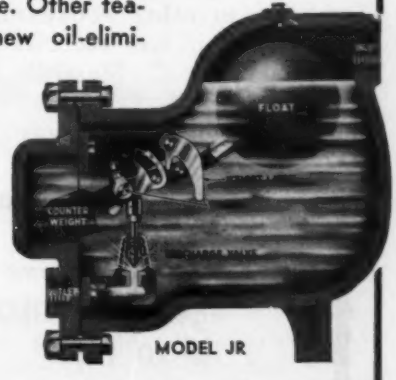
400 PREDA STREET • SAN LEANDRO, CALIFORNIA

NICHOLSON AIR-GAS-STEAM TRAPS

NEVER NEED PRIME

Nicholson weight-operated traps, under no condition, leak pressure medium. This prevents the costly loss of air, gas or steam occurring when inverted bucket traps lose their prime. Nicholson traps hold tight because they have a positive water seal and do not depend on buoyancy of float to raise valve. Other features: exclusive new oil-eliminator; special hardened stainless steel valve. 3 types; pressures to 200, 500 and 1500 lbs. Send for...

CATALOG 953



MODEL JR

213 Oregon St., Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

Post Scripts of Industry

News about people, manufacturers and sales organizations

The S-P Manufacturing Corporation, Cleveland, Ohio has announced appointment of **Beverly D. Smith Company** as an exclusive sales representative. Beverly D. Smith Company is located at 29 N. Dean St., Englewood, New Jersey. The territory which the firm will serve includes Manhattan and all of Long Island and southern New York state as far as Orange and Putnam counties. D. Lee Bassett, vice president and sales manager for S-P states that their new representative is well equipped to handle tooling and production problems.

Zurn Services, Inc., exclusive sales agents for American Flexible Coupling Company, Erie, Pa., has recently appointed **G. T. Collatz** as representative in its New England territory, with offices at 473 Washington Street, Wellesley, Mass.

Cliff G. Hartke has joined the Lynair organization as vice-president in charge of sales, **Lynair, Inc.,** Jackson, Michigan. In addition to other representatives, Lynair has recently appointed John C. Marshall and Associates and Frank A. Burnett Company of Cincinnati, as distributors in their respective areas.

John H. Adams has been named assistant chief engineer of the **Dollinger Corporation,** Rochester, N. Y. Prior to joining Dollinger, he was associated with Distillation Products Industries, Rochester, N. Y.

L. H. Gardner, president of Airmatic Valve, Inc., Cleveland, Ohio, announces the appointment of **M. S. Jacobs & Associates, Inc.** as Airmatic representatives for Western New York, Western Pennsylvania and West Virginia. They maintain offices in Buffalo, N. Y., Oil City, Pa., Pittsburgh, Pa. and Charleston, W. Va., and have been devoted to the sales and application engineering of instruments, controls and valves since 1945.

A further expansion by the **Reliance Electric and Engineering Company,** Cleveland, Ohio, in its engineering and technical service facilities on the West coast will include the establishment of a direct sales office in San Francisco and additions to its engineering personnel in both San Francisco and Los Angeles. **Walter A. Jensen,** formerly in the Buffalo, New York sales office goes to San Francisco where he will report to Andrew C. Perrin, the company's west coast

John H. Adams
Dollinger Corporation

M. S. Jacobs
M. S. Jacobs & Associates, Inc.

It is with extreme regret that we must announce the death of the General Manager of APPLIED HYDRAULICS Magazine, William J. Hargest, on November 10, 1953.

Mr. Hargest had become very well known throughout the hydraulics industry, and the news of his passing will come as a shock to all of his friends.

CLAD-SEAL® GASKETS

Best Protection

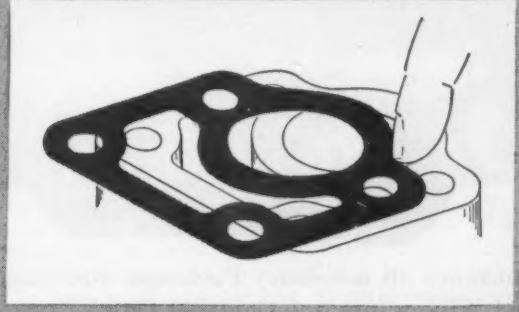
Against Leakage of LIQUIDS and GASES

Clad-Seal gaskets have a central stabilizing copper base cladded with lead on both sides. Overall thickness, held to close tolerance limits, permits accurate assembly spacing in pumps or similar applications.

The lead cladding provides ductile, inelastic sealing surfaces that do not cold-flow, extrude or separate from the strong supporting copper core.

The dimensional precision of this material together with its constant compressibility factor enables clamping force to be accurately predetermined and retaining screws accurately preloaded to limit fatigue stresses. Retained pressures may vary violently without corresponding fluctuations in retaining screw stresses.

The lead cladding does not deteriorate with age; is not affected by moisture or corrosion; does not shrink or swell and sheds no clogging particles or "whiskers".



Clad-Seals are easy and quick to install. Roughness or tool marks on joint surfaces do not cause leakage. No expensive precision machining is required. And Clad-Seals may be reused many times without loss of effectiveness.

LEAD ALLOY PRODUCTS COMPANY

9118 ROSELAWN AVE.
DETROIT 4, MICHIGAN

FOR FURTHER DETAILS WRITE OR PHONE FOR BULLETIN 5-51

district sales manager. **Perry Dudley, Jr.** for the past 15 months in the Cleveland offices moves to Los Angeles where he will report to H. A. Latta. Replacing Jensen will be **Peter W. West.**

Haven C. Babb
Standard Pressed Steel Co.

Haven C. Babb has been appointed assistant advertising manager of the **Standard Pressed Steel Co.** in Jenkintown, Pa. He has been in the advertising department since 1950. Before going with Standard Pressed Steel three years ago, he was assistant advertising manager at Globe Hoist Company. He served during the war in the Army Air Corps as aircraft technician.

L. J. MacKenna has been appointed district office manager of **Worthington Corporation's** Tulsa office, according to an announcement by T. J. Kehane, assistant vice president and general sales manager. MacKenna has been associated with the company's New York district office for the past twenty years. He joined the company in 1926 after graduating from Northeastern University in mechanical engineering.

C. B. Hunt & Son, Inc., Salem, Ohio, has announced the appointment of **Alfred Halliday,** with offices at Louisville, Memphis and Knoxville, as sales representatives for Kentucky, central and western Tennessee, northern Mississippi and Arkansas.

Harry J. Scott has joined the **Pesco Products Division** of Borg-Warner Corp. at Bedford, Ohio, as a sales engineer specializing in automotive hydraulic steering applications. Scott came to Pesco from the Saginaw Steering Division of General Motors Corp. where he was project engineer in charge of new developments on hydraulic power steering.

Almo Tool Company has announced the opening of their new plant and offices at 11470 Kaltz Ave., Center Line, Mich.

Anker-Holth of Port Huron, Michigan, Division of The Wellman Engineering Co., has announced a change of representatives in its Youngstown, Ohio sales territory. New representative will be Paddon Company,

MONOPAK-CARTRIDGE PACKING UNIT!

For Pneumatic and Hydraulic Cylinders

Combines all necessary Packings, Bearings and Rod Wipers into one Compact Unit.

Can be installed or replaced by totally inexperienced mechanics within a few seconds.

Write for Literature

HYDRAULIC ACCESSORIES CO.

24301 HOOVER RD. • VAN DYKE, MICHIGAN

Circle 54 on Reader Service Card

Introducing...

the SKINNER V10 MINIATURE PRECISION HYDRAULIC VALVE

Skinner's new V10 Series Miniature Hydraulic Valve is an amazingly compact unit, capable of handling pressures up to 1000 P.S.I.

This precision-made valve is ideally fitted for use in the automatic operation of single and double acting hydraulic cylinders, and in pilot control of larger three and four way hydraulic valves.

The V10's construction is consistent with the Skinner quality tradition: most internal parts are of stainless steel; the slide mechanism has a precision-ground piston, and a bore honed to extremely close tolerance, thus minimizing leakage.

Specifications: 1/8" NPT threaded ports; effective orifice diameter of 3/32"; available in the full range of AC and DC voltages.

The economical design and unusually small size of the Skinner Miniature Hydraulic V10 valve will enable many manufacturers to install it in places where, heretofore, remote control devices have been considered impractical.

SKINNER ELECTRIC VALVES — Skinner ELECTRIC VALVE DIV.

THE SKINNER CHUCK COMPANY
105 Edgewood Ave., New Britain, Conn.

Circle 95 on Reader Service Card

a recently formed partnership of **Don M. and Fred H. Paddon.** They replace the F. J. Bowers Company. The change occurred when Frank J. Bowers retired from active representation. He has been retained on a consulting basis by the Paddon Company.

A new stock carrying factory warehouse and sales office has been established at 4384 E. Bandini Blvd., Los Angeles, California, by **Quaker Rubber Corp.,** Division of H. K. Porter Company Inc., Philadelphia, Pa. The new branch is under the supervision of **James Joyner.**

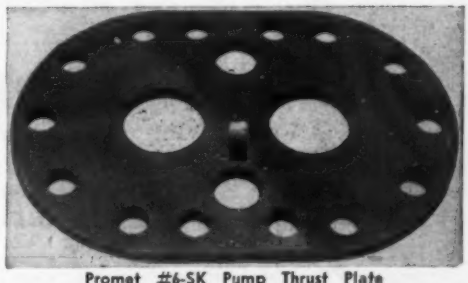
The Heat-X-Changer Co., Inc. of Brewster N. Y. has announced the appointment of the General Hydraulics Co. of Newark, New Jersey as sales representative in the Northern New Jersey territory. Partners in General Hydraulics Co. are **Eugene V. Barkow** and **John C. Swatsworth.** For twelve years prior to enter-

Circle 8 on Reader Service Card

PROMET
THE Engineered BRONZE

BEARINGS-BUSHINGS-WEARING PARTS
(machined or rough cast)

Designers of road machinery specify sand-castings of Promet bronze alloys selected for hardness, self-lubrication, and resistance to shock and friction. Manufacturers of road machinery specify Promet because it guarantees that the alloy will be correct for the application, finishes will be to tolerance specified, and delivery will be as scheduled.



Promet #6-SK Pump Thrust Plate

The American Crucible foundry is one of the most modern in America. A mechanized production line includes jolt squeeze machines, sand conditioners, sand conveyors, shakedown stations, castings conveyors, shot and sand-blasting machines for cleaning castings—equipment which permits the manufacture of a product of unsurpassed quality.

When American Crucible serves your bearing and wearing requirements, you get a money-back guarantee of longer service and lower maintenance cost. Castings to your patterns—any size, shape or section up to 3,000 lbs. Pattern making, designing and machining.

Write today for FREE LITERATURE and service data sheets. Send blueprints, conditions of operation and other data for recommendations and quotations.

THE AMERICAN CRUCIBLE PRODUCTS CO.
1303 OBERLIN AVENUE LORAIN, OHIO, U. S. A.

REVOLVING JOINTS
For Air And Hydraulic Pressure

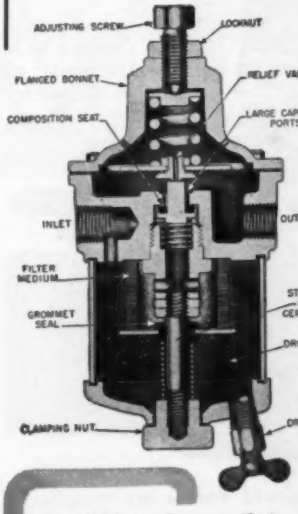
for single and double acting cylinders

SEVEN STYLES
SIZES ¼" to 5" INCL.

Double passage joints—where both outlets can rotate on different centers or in opposite directions at the same time. The Rotherm Revolving Joints compensate for thread misalignment without binding.

Air and fluid through the same joint. Exceptionally low turning torque.

Rotherm **ENGINEERING COMPANY, INC.**
7280 Devon Ave. Chicago 31, Ill.



DOUBLE VALUE
CONO AIRPAK
—REGULATES
—FILTERS
IN A SINGLE UNIT

The advantages of a high quality large capacity reducing valve with safety relief, and an efficient air filter, are combined in a single compact unit. Save space and installation costs by eliminating the use of separate units. Pressure gauge can be mounted integrally. Construction is rugged, corrosive resistant and long lasting. Available in a variety of ranges and dripwell capacities for production equipment, instruments and controls, spraying equipment, and pneumatic gauges. Write for BULLETIN FH-15 to get full details.

CONOFLOW CORPORATION
2100 ARCH ST.
PHILADELPHIA 3, PA.

Cono-Controls

CC-116

Circle 94 on Reader Service Card

Circle 25 on Reader Service Card

ing the partnership Barkow was project engineer and experimental supervisor for Electrol, Inc. Swatsworth has covered the Northern New Jersey area as sales representative for hydraulic and pneumatic manufacturers for three and a half years.

E. S. Taylor, general manager of the **Hydro-Line Manufacturing Co.**, Rockford, Illinois, recently announced the appointment of **John H. Harding** as sales manager. Harding has been with the company since 1951 in the capacity of sales engineer.

The appointment of **Stout & Loman** as representatives for the state of Indiana has been announced by **D. Lee Bassett,** vice-president and sales manager of **The S-P Mfg. Corp.**, Cleveland, Ohio. Stout & Loman have offices at 712 Sycamore St., Kokomo, Indiana. They will be sales representatives for all of Indiana except Lake and Wayne counties.

The Roden Company of Cranford, New Jersey has been appointed as representative of the Ortman-Miller Machine Company in the upper New Jersey area. **Norman Roden** of this company has had years of training and experience in the pneumatic and hydraulic fields.

Louis W. Davis of Huntington, New York has been appointed director of public relations and advertising for **Air Associates, Inc.**, according to an anouncement by J. E. Ashman, company president.

Bendix Aviation Corporation has begun construction of a new engineering building to accommodate expansion of its Pacific Division's airborne and hydrau-

John H. Harding
Hydro-Line Manufacturing Co.

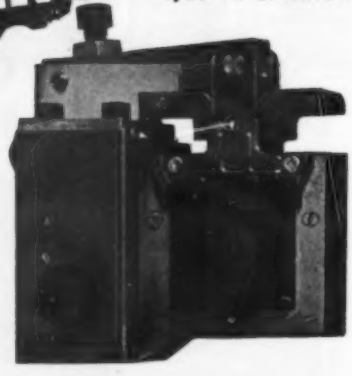
Norman Roden
The Roden Company

NEW HIGH PRESSURE
SOLENOID VALVES

Now available in 110—220 volts 60 cycle A. C. current

Features

- Rugged compact construction.
- 3000 P.S.I. operating pressure
- Continuous duty
- Poppet design eliminates leakage
- May be mounted in any position
- Impregnated coils resist moisture and condensation



Waterman High Pressure Solenoid Valves are inexpensive, compact units designed for continuous duty in hydraulic systems where pressures are as high as 3000 P.S.I. Poppet type construction gives positive sealing against internal leakage. Impregnated oil resistant coils make these valves suitable for mounting in oil reservoirs. In many cases this feature eliminates costly piping and makes possible the construction of smaller, more compact hydraulic power units. Available in ⅜" and ¾" pipe size.

Write for Illustrated Circular A

WATERMAN ENGINEERING Company
725 CUSTER AVENUE
EVANSTON, ILLINOIS

Dukes
PRECISION HYDRAULICS

- HYDRAULIC AND PNEUMATIC CYLINDERS
- FOUR WAY VALVES, COUPLERS AND PUMPS
- STANDARD PRODUCTS OR BUILT TO YOUR SPECIFICATIONS
- OUR REPUTATION IN THE AIRCRAFT INDUSTRY IS YOUR GUARANTEE OF A PRECISION PRODUCT.

FOR HYDRAULICS— THE DUKES COMPANY IS YOUR ANSWER!

Dukes COMPANY
2108 N. SOUTHPORT - CHICAGO 14, ILL.
Phone DIversey 8-6326

Circle 117 on Reader Service Card

Circle 126 on Reader Service Card

lic engineering departments. The new building is the fourth to be built since 1948 to take care of the division's growth.

The Darling Valve & Manufacturing Company, Williamsport, Pa., through its president, Marshall L. Hough, announces the selection of **Frank B. Kreider** as general sales manager. Mr. Kreider is a graduate of Carnegie Institute of Technology in management engineering and a registered professional engineer. He served in the Corps of Engineers during World War II. For the past four and one-half years he has been Eastern regional manager, Insulation Division, for Pabco Products, Inc.

Members of the board of directors of **Pacific Airmotive Corporation** elected **Roy Backman,** former aviation products sales manager, to the new post of vice president product sales. A former general sales manager for Western Air Lines and vice

Circle 10 on Reader Service Card

Small Quantity ORIGINAL or REPLACEMENT PISTON RINGS at ATTRACTIVE PRICES!

Small quantity Piston Rings are sometimes hard to get in a short time at attractive prices. We have specialized in this type of business since 1921 and are serving several hundred accounts—many of them exclusively for a good many years. We also make circular parts to your specifications. Auto-Diesel Piston Rings are made up to 35" diameter for original equipment and for replacement in compressors, hydraulic cylinders, valves, etc. Write for prices.

Write for Prices AUTO-DIESEL SCRAPER RINGS AN 6231 . . 1 to 71

Auto-Diesel Bronze Scrapper Rings are precision made by men who have spent years making quality rings. They are LONG-WEARING because they are made right and therefore reduce down-time to a minimum. They have been tested at 2,250,000 cycles and found to fit perfectly. Can supply sizes from ½" to 13" I.D. Can supply rings and circular parts for jet engines. You are requested to write our Engineers regarding any ring problem you may have. They are well qualified by years of experience to advise you.

Write for Details

THE AUTO-DIESEL PISTON RING CO.
3137 Superior Avenue • Cleveland 14, Ohio
"RINGS and SHAPES Since 1921"

WAR SURPLUS SAVINGS

SAVE UP TO 85%

NEW INSIDE – OUTSIDE VERNIER CALIPERS
German made by one of Europe's leading specialists in precision tools. Measures inside-outside & depth in .001" to 6" in 1000ths and 1/10mm to 150mm in 10ths. 9.75
MICROMETERS – 0" to 1" in 1,000ths. . . . 9.75
Has lock-nut & ratchet ...ONLY – . . . .

STAND MAGNIFIER
Handy stand magnifier with universal adjustments. Overall height 6". Has powerful, clear magnifying lens. 1.49

BENDIX HYDRAULIC PUMP & MOTOR
Has 3-1/2 GPM capacity at 600 PSI. Motor is 1½ HP, 24V, D.C. Will operate on either 12 or 32V, DC current. Has built-in relief valve adj. to 1500 PSI. This unit ideal for hyd. lifts, portable loaders, etc. 19.50

MAGNETIC BASE – INDICATOR HOLDER . . .
A time saver for precision checking. Magnetic base fits curved or flat surface. Has 45-50 lb. pull. Stainless steel 6½" rod mounted in ball socket permits universal settings 3.95
Note: We have complete line of instruments, depth gauges, inspection mirrors, etc. WRITE TODAY

HYDRAULIC HAND PUMP
Operating pressure 2000 PSI. Cap., 1.5 cu. in per complete cycle . . 12.75

GEAR HEAD MOTORS
Heavy duty, G.E. Gear Head motor. 2 HP, 24V. DC, 125 amp., reversible motor drives a reduction gear unit giving 36 to 1 ratio at take-off. Also will operate on 6 or 12 volts.
36 to 1 G.E. (206 shaft RPM)
28 to 1 Eclipse (130 shaft RPM)
40 to 1 Eclipse (110 shaft RPM)
10.95 EA.

HYDRAULIC ACCUMULATORS
A-2B FLOATING PISTON TYPE – 4"x 18" Built to stand 2,000 PSI 12.75
A-5 VICKERS – 10" dia. Bolt type. Built to stand 2000 P.S.I. 24.75

ELECTRIC ACTUATORS
Hundreds of uses for any mechanical device needing controlled 2 way action. Opens, closes, raises or lowers doors – windows – gates – valves.
CTU-2 – Foote Linear Actuator – 24 volt, DC, 8500 RPM, 1/6 HP – series wound motor. 4½" stroke in 13½ sec. Compression and tension loads up to 750 lbs. Adjustable micro switch for limits of travel. Overall ingth., retracted 11" 7.95
We also carry many more sizes and types of Actuators. Write today for information.

HYDRAULIC CYLINDERS
Gives 20,000 lb. thrust (push or pull) using 1500 PSI line pressure as obtained from our hydraulic pumps. Will produce up to 40,000 lb. thrust with 3000 PSI. Can also be used on low pressure air systems. 4" bore; 18" stroke; 30½" length. Ideal for rear farm – shop machinery. 29.75

No. 3 HYDRAULIC CYLINDER
Double action. Bore is 1" – Shaft ½". Has stroke of 2½" to 4". Stroke can be adjusted with internal sleeve stops. Overall length is 6½". Will take 1500 lbs. continuous duty. 3000 lbs. intermittent. Will lift or push up to 1100 lbs. 5.75
We stock over 50,000 Hydraulic Cylinders, Valves, Pumps, Accumulators, Hand Pumps, Motors, Hose, etc. All at Money Saving Prices.

230 Pg. CATALOG
Amazing Values! 1000's of items for Mfgr., Mechanic, Sportsman, etc. Save on Machine Tools, Hydraulics, Pumps, Valves, Hand & Power Tools, Instruments, etc. Send for your copy today!

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2263 E. VERNON AVE.
Dept. AH-12
LOS ANGELES 58, CALIF.
Order from this ad. Pay by M.O. or check. P.O.'s accepted from D&B firms. ½ deposit with C.O.D.'s.
All Prices F.O.B. Los Angeles

REPUBLIC
VALVES
INDUSTRIAL • CHEMICAL • AIRCRAFT

J.I.C. AND AN STANDARD TUBE ENDS

Skilfully engineered 2, 3, and 4-way Plug Valves are built by Republic in brass and aluminum alloy, sizes ⅛" to 1". Hydraulic Relief Valves opening at pressures up to 450 psi made in brass, aluminum alloy, steel, and stainless steel, sizes ⅛" to ¾". Pipe, AN or J.I.C. tube ends, or combinations.

4-WAY PLUG VALVE, WITH DRAIN

Also manufacturers of high quality globe, needle, low and hy-pressure check valves, and special valves to specifications.

Write for complete catalog and name of nearest distributor.

83

RM REPUBLIC MANUFACTURING CO.
1930 WEST 77TH STREET • CLEVELAND 2, OHIO

president in charge of sales and traffic of Alaska Air Lines. Mr. Backman is well known in aviation circles. He joined PAC as a consultant to the sales division in early 1952. With his new responsibilities, Mr. Backman will administer PAC's products sales program at the company's home offices in Burbank as well as the branch offices. He will direct the export sales department.

K. Brad Stiles has resigned as sales manager of Chicago Belting Company and formed his own company, known as **Brad Stiles Mechanical Packings Inc.**, with offices located at 7001 North Clark Street, Chicago 26, Ill.

Jordan E. Johnson has recently been assigned by **Vickers Incorporated** to the position of aircraft application sales engineer for the Mid-Atlantic area, including Philadelphia and Baltimore. He will continue to be based at the main Vickers factory in Detroit. Johnson has been associated with Vickers for the past twelve years in both engineering and sales capacities. Recently his prime activity has been special assignments involving the sale and application of Vickers electro-hydraulic servo type equipment.

The board of directors of **The Cuno Engineering Corporation,** Meriden, Conn., has elected **Wilfred G. Schneider** to the post of vice-president in charge of manufacturing. Prior to joining Cuno in April 1952, Schneider has been associated with several manufacturers of industrial products in Connecticut and had served as vice-president of the Middlesex Manufacturer's Association.

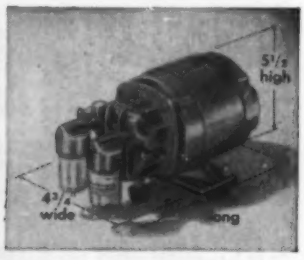
Jordan E. Johnson
Vickers, Incorporated

K. Brad Stiles
Brad Stiles Mechanical Packings Inc.

Announcing Two Compact

NEW GAST ROTARY Integral-MOTOR AIR PUMPS

FOR ORIGINAL EQUIPMENT APPLICATIONS AND PORTABLE USES



Note the compactness! Yet these Integral Motor-Pumps (basic Model No. 0406 shown) deliver .6 CFM—to 15 PSI or 25 inches Vacuum. 1750 RPM with 1/12 HP G.E. Motor.

It's a VACUUM PUMP! For vacuum, Model 0406-V2-154X has already proved its advantages as a component of industrial instruments requiring air flow; as a portable air sampler, etc.

It's an AIR COMPRESSOR! For pressure, Model 0406-P2-154X is in use on special machines for textile wear testing; as a laboratory compressor, etc.

Both OIL-LESS AND STANDARD LUBRICATED TYPES OFFERED—VARIOUS ACCESSORIES

Write FOR NEW DATA SHEETS on 0406 Integral Motor-Pump Models.

You can get absolutely oil-free air with completely oil-less models (never need lubrication); also standard lubricated models. Altogether, Gast offers a wide range of Integral Motor-Pump Models from 1/12 to 1/3 HP. *Investigate now!*

Same model, but with handle, gauges, nipples, etc., to show typical accessories we can furnish.

Original Equipment Manufacturers for Over 25 Years

GAST ROTARY AIR MOTORS • COMPRESSORS • VACUUM PUMPS
(TO THREE H.P.) (TO 30 LBS.) (TO 28 INCHES)
GAST MANUFACTURING CORP., 131 Hinkley St., Benton Harbor, Mich.

Circle 41 on Reader Service Card

The Biggest PLUS VALUE in Cylinders

For hydraulic pressures up to 1500 or 3000 p.s.i.

They're sturdy—dependable—economical

Use the hydraulic cylinder that will always give you plus performance in your equipment. Designed and constructed to J.I.C. standards, NEPTUNE-POWER PLUS cylinders are available in seven standard mountings—series 1500 for oil and water pressures to 1500 p.s.i.—series 3-1500 for pressures to 3000 p.s.i.

- Bores from 1 to 24 inches —Strokes to 18 feet.
- Pressure ring design permits head rotation to any pipe location.
- Precision fitted piston rings prevent by-pass while offering minimum friction.
- One piece high pressure, self-adjusting, rod packing provides precision bearing and guide for piston rod.
- Single or double end rods, with cushion.
- Other series available for air pressure.

Write for Catalog AH

NEPTUNE-POWER PLUS PRODUCTS CO.
2228 Bellevue Ave. Detroit 7, Michigan

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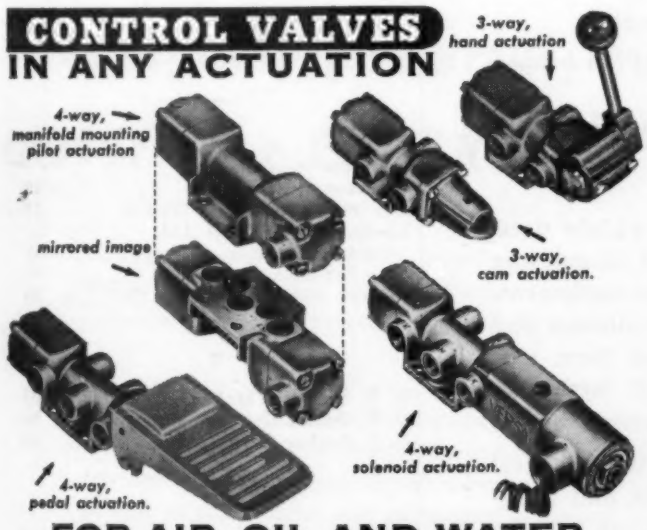

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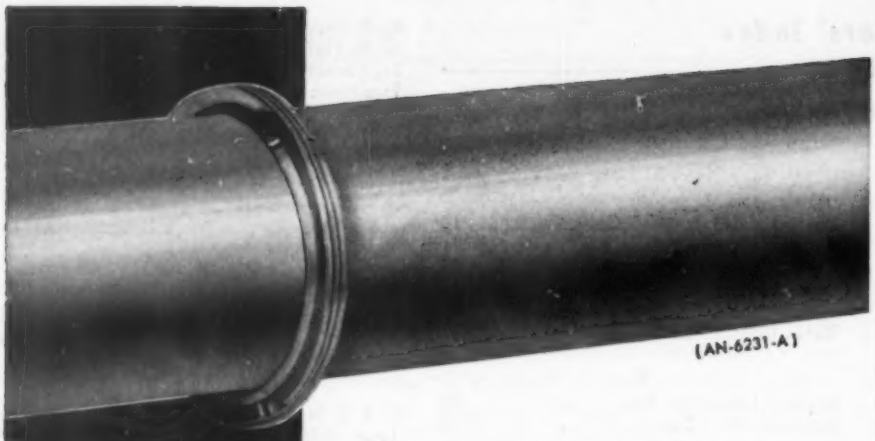

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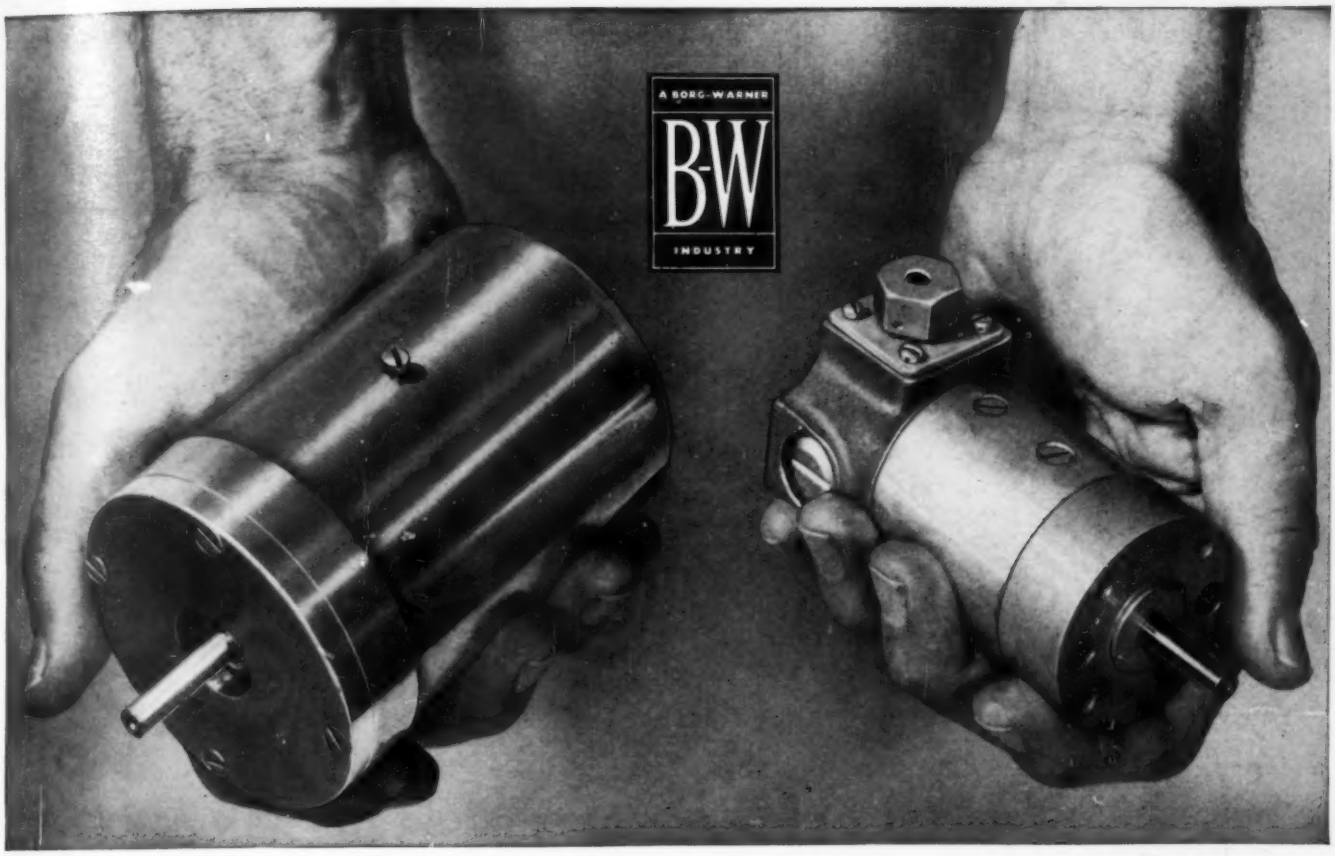

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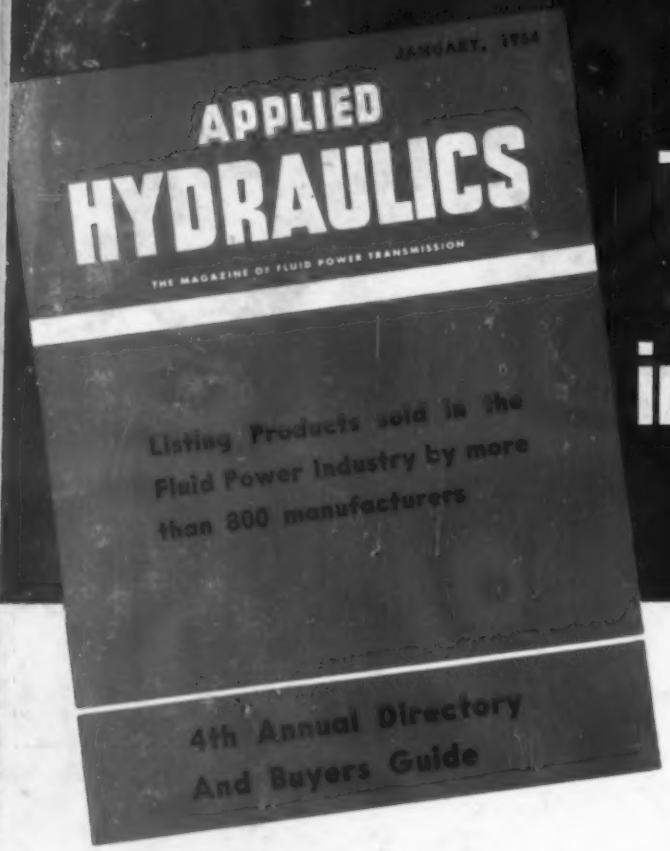
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